Different Peach Cultivars and their Suitability for Minimal Processing

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Abstract

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Consumption of minimally processed fruits has been increased lately mainly due to their fresh-like quality characteristics. One of the major alterations that limit the shelf-life of these products is browning caused by polyphenol oxidase (PPO) activity on phenolic compounds. Six yellow-flesh peach cultivars, Spring Lady, Royal Glory, Ruby Rich, Summer Rich, Ryan Sun, and O'Henry, were selected. Peaches were hygienised and then samples were processed in a clean room. Slices were washed in cold tap water, dried, packaged in modified atmosphere, and stored at 4°C during 9 days; physicochemical and other quality parameters were studied. Principal Component Analysis (PCA) and correlation study were carried out in order to evaluate the relation between variables and cultivars. In conclusion, Spring Lady, Royal Glory, and Ruby Rich cultivars were the cultivars that offered the most suitable fruits for fresh-cut processing, mainly due to their low BP and PPO activity.

Keywords: fresh cut fruit; visual quality; enzymatic browning; phenolic content; polyphenol oxidase

Modern consumers due to their lifestyle are demanding fresh and healthy ready-to-eat. Minimally processed products provide an opportunity to increase healthy food consumption (Rico *et al.* 2007). These products are popular for their ease of consumption and its nutritional content but they are usually highly perishable. Therefore, maintaining firmness and preventing browning are required in order to extend shelf-life, with cultivar selection playing an important role (Arias *et al.* 2008; Toivonen & Brummell 2008).

Fruits are of great interest due to the presence of natural compounds such as vitamins (C and E), carotenoids, and phenolic compounds that can act as natural antioxidants (Robles-Sánchez *et al.* 2007). Natural phenols have been reported to have excellent properties as food preservatives as well as to play an important role in the protection against numerous pathological disturbances (Haminiuk *et al.* 2012). Peaches, even though having the total antioxidant capacity lower than other fruits (Wolfe *et al.* 2008), are economically and nutritionally important because they can be a significant component of the diet during spring and summer because they are consumed in large quantities (Remorini *et al.* 2008).

The shelf-life of minimally processed fruit is generally more limited by changes in their sensory properties rather than by microbial growth (Ares *et al.* 2008). Appearance of a fresh-cut fruit is the most obvious attribute to the consumer, and strongly affects the decision to buy (Pace *et al.* 2011). Browning is a particular problem in fruit with white and/or yellow flesh such as apples, pears and peaches among

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others that appears as a consequence of polyphenol oxidase (PPO) action on phenolic compounds to form quinones, which are responsible for browning (Barbagallo *et al.* 2012). A dip treatment with antioxidant agents after peeling and/or cutting is the most common way to control browning phenomena in fresh-cut fruit, because it can either affect the enzyme or their substrates (Ghidelli *et al.* 2013).

Among cultivars within a species there might be differences in behaviour when undergoing minimal processing, which may offer very different result in fresh-cut qualities (Hodges & Toivonen 2008). For this reason it is essential to study the response of different cultivars to the stress caused by minimal processing in order to find the most suitable cultivars.

Some authors have concluded that the shelf-life of sliced peach and nectarine can vary from 2 to 12 days at 0°C, due to cut surface browning, and this can be a limiting factor to their commercial success (Gorny *et al.* 1999). For this reason, the aim of this work was to study different peach cultivars and assess their aptitude for minimal processing according to several quality parameters such as colour evolution, browning and phenolic content.

MATERIAL AND METHODS

Plant material. Six yellow flesh peach (*Prunus persica* /L./ Batch) cultivars supplied by ACOPAEX S.A. (Extremadura, Spain) were selected and ordered according to their harvest date: Spring Lady (May 30th), Royal Glory (June 15th), Ruby Rich (June 20th), Summer Rich (July 7th), Ryan Sun (August 11th), and O'Henry (August 16th). The fruits were harvested at the commercial ripening stage and transported to our laboratory, sorted to eliminate damaged or defective fruit, and stored at 4°C until use, within 24 hours.

Minimal processing. The whole fruits were prewashed in chilled water (4°C) containing 100 mg/l of sodium hypochlorite (adjusted to pH 6.5 with citric acid) for 2 minutes. The peel and stone were manually removed. Each fruit was cut into slices with sharp stainless steel knives, washed in tap water at 4°C during 2 min and then dried applying a stream of cold air (4 min). The peach slices (around 90 g) were packaged in polypropylene (PP) trays thermosealed with a PP film (TECAPACK, S.L., Cordoba, Spain). Quality analyses on peach slices were carried out at the beginning of each experiment, and after 3, 6, and 9 days of storage at 4°C.

Total soluble solids, titratable acidity and pH determination. Total soluble solids (TSS) content of a homogenate was determined by refractometry using a R40 refractometer (Mettler Toledo, S.A.E., Coslada, Madrid, Spain); results are expressed as °Brix. Titratable acidity (TA) and pH were quantified using a T50 DGI111-SG automatic titrator (Mettler Toledo, SAE, Coslada, Madrid, Spain). Values were expressed as percentage of malic acid. Acceptability index (TSS/TA) was calculated.

Firmness evaluation. Firmness was evaluated using a TA-XT2i Texture Analyser (Aname, Pozuelo, Madrid, Spain) which comprises the Texture Expert software for data processing. Measurements were carried out by a penetration test, using an 8 mm diameter probe. Ten intact fruits were tested twice, at distally opposite sites from each sample. Firmness was expressed as N.

Colour measurement. Colorimetric measurements were carried out using a colorimeter (Minolta Chroma Meter model CR-200; Konica Minolta Sensing, Inc., Osaka, Japan) with an 8 mm diameter viewing area and D65 illuminant, showing the results in CIELAB space coordinates. Twenty measurements were performed at the central points of the slices from each sample. Colour parameters used to estimate changes in appearance of processed fruit during storage were lightness (L^*), a^*, b^*, and hue angle ($h°$) calculated from Eq. 1 (Voss 1992; Hutching 1994).

$$h° = \arctan b^*/a^* \qquad (1)$$

Browning potential. Browning potential (BP) was determined using the procedure described by other authors (Arias *et al.* 2008) slightly modified. Ten grams of homogenate were centrifuged at 14 000 rpm during 15 min at 4°C. The supernatant was filtered through a 110 mm diameter (0.45 mm pore size) filter paper. Finally the resulting clear juice was measured at 440 nm with a spectrophotometer (UV-2401 PC Shimadzu; Shimadzu Scientific Instruments, Inc., Columbia, USA). Four replications were evaluated from each sample. The results were expressed as absorbance units.

Total phenolic content. Total phenolic content (TPC) was determined by spectrophotometry described elsewhere (Lima *et al.* 2005) with slight modifications, using the Folin-Ciocalteu reagent. Fruit extracts were prepared from homogenised material and extracted in 90 ml of ethanol dilution (80%) acidified with hydrochloric acid (1%). Afterwards, the solvent was evaporated in an R-210 rotary evaporator (Buchi, Labortechnik AG, Flawil, Switzerland) at 38°C until 5–10 ml were achieved. This volume was centrifuged at 14 000 rpm during

15 min at 4°C on a centrifuge (Allegra 25R; Beckman Coulter™, Palo Alto, USA), and the supernatant was diluted to 50 ml with bidistilled water. Colorimetric reaction was carried out adding 1 ml of Folin-Ciocalteu reagent (Merk) to 2–3 ml of solution. After 3 min, 2 ml of sodium carbonate (20%) was added and diluted with distilled water to a final volume of 20 ml. After an hour (in darkness and cold temperature), the absorbance was measured at 760 nm with a UV-2401 PC Shimadzu spectrophotometer (Shimadzu Scientific Instruments, Inc., Columbia, USA). TPC was expressed as mg gallic acid/100 g fresh sample.

Determination of polyphenol oxidase activity. Polyphenol oxidase activity (PPO) was spectrophotometrically determined according to the method developed by Soliva-Fortuny *et al.* (2001) with slight modifications and using a 0.07M catechol solution as substrate. Peach extract was prepared from 5 g of homogenate which were added 10 ml of extracting solution. This extracting solution contained phosphate buffer (0.2M, pH 6.5, Panreac), NaCl (0.1M, Panreac), 4% polyvinylpyrrolidone (Merk, Darmstadt, Germany), 1% Triton X-100. The mixture was homogenized with an IKA T-10 basic Ultra Turrax (IKA® Werke, Staufen, Germany) for 3 min in cold. Then, the mixture was centrifuged (Allegra 25R) at 20 000 rpm during 30 min at 4°C. The supernatant was filtered through a 110 mm diameter (0.45 mm pore size) filter paper and diluted to 10 ml with 0.2M phosphate buffer. The test mixture consisted of 2.9 ml catechol solution and 100 µl enzyme extract. Enzymatic activity was measured by monitoring the absorbance at 400 nm using a UV-2401 PC Shimadzu spectrophotometer (Shimadzu Scientific Instruments, Inc., Columbia, USA). One unit of enzymatic activity was defined as the increase of 0.001 units of absorbance per minute. The results were expressed as Ug/minute.

Statistical analysis. Statistical analysis was carried out using a Statistical Package (SPSS, Vers. 18.0; Chicago, USA). One-way ANOVA test was used for statistical data analysis and Tukey's test was applied when significant differences were found ($P < 0.05$). Correlations between parameters were estimated by the Pearson test with a confidence level of 95% ($P < 0.05$). Moreover, all analysed parameters were subjected to principal component analysis (PCA) to evaluate relationships between them.

RESULTS AND DISCUSSION

Total soluble solids, titratable acidity and pH. TSS showed a different behaviour in each cultivar (Table 1). TSS decreased for cvs Spring Lady, Ruby Rich, and Ryan Sun, and increased in others such as cvs Summer Rich and O'Henry, and showed oscillations during storage in cv. Royal Glory. Cv. Ryan Sun had the highest TSS content at the beginning and the end of storage. Whereas cv. Summer Rich had the lowest content at the beginning of storage and cv. Spring Lady had the lowest content at the end. The differences in initial TSS between the various cultivars might be explained by the fact that they are related to the date of harvest, with the late cultivars being richer in sugars than the early ones.

TA of the peach slices showed significant differences between the cultivars (Table 1). Cv. Ruby Rich showed the highest TA and cv. Royal Glory the lowest. A marked decrease in acidity occurred for all cultivars except cv. Royal Glory which was maintained from day 3 to day 9 and in cv. Summer Rich where the acidity increased until day 6 and then decreased until the end. In general, pH increased during storage, possibly related to TA decrease. Royal Glory cv. had the highest pH value.

It was found that cv. Royal Glory could have good consumer acceptability, because it was the cultivar with the highest TSS/TA (Table 1). Cvs Ryan Sun and O'Henry also had a high index. Crisosto and

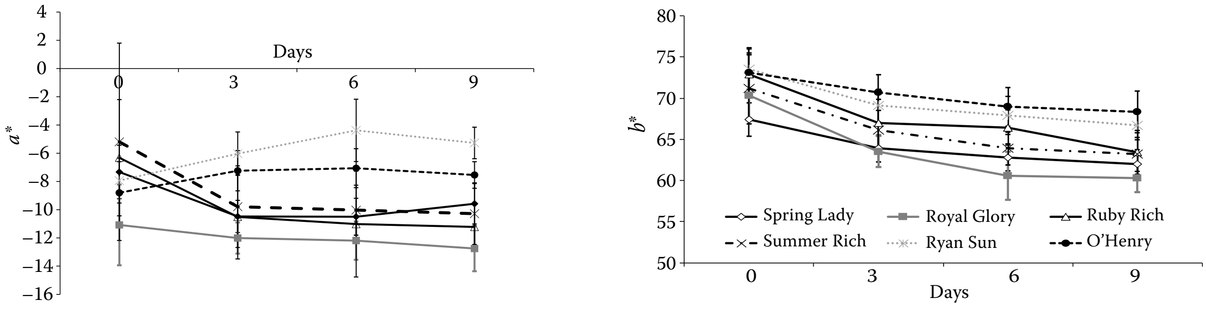

Figure 1. Changes in a^* and b^* colour parameters in minimally processed peach cultivars during 9 days of storage at 4°C

Vertical bars represent standard deviation of the mean (n = 20)

Table 1. Physicochemical characteristics of fresh-cut peach cultivars stored at 4°C for 9 days

	Day	TSS (°Brix)*	TA (% malic acid)*	pH*	TSS/TA*	Firmness (N)**
Spring Lady	0	10.25 ± 0.06[a]	0.889 ± 0.001[a]	3.56 ± 0.01[c]	11.52 ± 0.70[d]	19.91
	3	9.38 ± 0.05[b]	0.635 ± 0.005[c]	3.64 ± 0.01[b]	14.75 ± 0.91[a]	
	6	8.63 ± 0.10[c]	0.654 ± 0.005[b]	3.66 ± 0.01[b]	13.19 ± 0.19[c]	
	9	7.90 ± 0.08[d]	0.573 ± 0.001[d]	3.75 ± 0.01[a]	13.80 ± 0.14[b]	
Royal Glory	0	10.33 ± 0.10[b]	0.375 ± 0.005[a]	4.12 ± 0.01[b]	27.54 ± 0.34[d]	34.64
	3	11.43 ± 0.05[a]	0.313 ± 0.010[b]	4.30 ± 0.01[a]	36.69 ± 0.80[a]	
	6	9.63 ± 0.05[c]	0.313 ± 0.005[b]	4.25 ± 0.01[a]	30.73 ± 0.06[c]	
	9	10.28 ± 0.17[b]	0.300 ± 0.001[b]	4.32 ± 0.09[a]	34.25 ± 0.39[b]	
Ruby Rich	0	11.00 ± 0.08[a]	1.010 ± 0.001[a]	3.40 ± 0.01[d]	10.91 ± 0.09[b]	23.58
	3	10.18 ± 0.29[b]	0.870 ± 0.001[c]	3.50 ± 0.01[b]	11.72 ± 0.33[a]	
	6	8.98 ± 0.05[c]	0.910 ± 0.001[b]	3.42 ± 0.01[c]	9.88 ± 0.05[c]	
	9	9.10 ± 0.01[c]	0.760 ± 0.001[d]	3.58 ± 0.01[a]	11.99 ± 0.02[a]	
Summer Rich	0	7.93 ± 0.13[d]	0.768 ± 0.010[c]	3.80 ± 0.01[b]	10.35 ± 0.27[d]	33.08
	3	9.55 ± 0.06[c]	0.799 ± 0.001[b]	3.75 ± 0.01[c]	11.95 ± 0.08[c]	
	6	10.30 ± 0.01[a]	0.821 ± 0.001[a]	3.75 ± 0.01[c]	12.54 ± 0.02[b]	
	9	10.10 ± 0.01[b]	0.605 ± 0.005[d]	3.87 ± 0.01[a]	16.70 ± 0.03[a]	
Ryan Sun	0	14.08 ± 0.32[a]	0.763 ± 0.005[a]	3.70 ± 0.01[d]	18.33 ± 0.36[c]	44.01
	3	12.68 ± 0.15[b]	0.623 ± 0.005[b]	3.79 ± 0.05[c]	20.34 ± 0.25[b]	
	6	11.60 ± 0.08[c]	0.545 ± 0.017[c]	3.91 ± 0.01[b]	21.30 ± 0.68[b]	
	9	11.90 ± 0.01[c]	0.510 ± 0.001[d]	3.99 ± 0.01[a]	23.24 ± 0.04[a]	
O'Henry	0	10.75 ± 0.06[c]	0.594 ± 0.009[a]	3.76 ± 001[d]	18.08 ± 0.26[c]	41.14
	3	11.65 ± 0.10[a]	0.539 ± 0.002[b]	3.80 ± 0.01[c]	21.54 ± 0.16[b]	
	6	10.88 ± 0.10[bc]	0.479 ± 0.003[c]	3.86 ± 0.01[b]	22.62 ± 0.15[b]	
	9	10.98 ±0.05[b]	0.459 ± 0.020[c]	3.96 ± 0.01[a]	23.82 ± 1.01[a]	

TSS – total soluble solids; TA – titratable acidity; TSS/TA – acceptability index; values for the same cultivar and the same parameter followed by different letters indicate significant differences by Tukey's test ($P < 0.05$); *mean ± standard deviation ($n = 4$); **firmness values obtained from the whole fruit at the beginning of the trial ($n = 10$)

Crisosto (2005) stated that the consumer acceptability is closely related to the type of cultivar and other quality attributes such as fruit aroma intensity, flavour and texture, and therefore sweetness and acidity indexes cannot be generalised.

Firmness. Although the fruit was harvested according to commercial criteria for fresh fruit distribution according to ripening values (> 13–27 N) given by Gorny *et al.* (1998), firmness results showed that Spring Lady and Ruby Rich cultivars were partially ripe (Table 1), whereas the rest of the cultivars offered higher firmness.

Colour evolution. Some authors evaluate browning using (L^*) and ($h°$) as good indicators of the surface browning because their decrease is associated with an increase in the intensity of browning of minimally processed fruits such as apple, pear and peach (González-Buesa *et al.* 2011). However, L^* and $h°$ values presented an increase for most of the cultivars, this could be related to the development of whitish colour of the sliced surface. This behaviour is known as white blush and it was described for peach and nectarine (Boun & Huxsoll 1991; Gorny *et al.* 1998), it was concluded that white blush was caused by lignin formation. On the contrary, for cv. Ryan Sun, both parameters were decreased and for cv. O'Henry, $h°$ was decreased. Table 2 shows small decreases in L^* and $h°$ which were significant changes, so the tissues of these cultivars were rather brown. This might explain the sharp a^* increase for cvs Ryan Sun and O'Henry (Figure 1).

Other authors associate changes in a^* as a good indicator of the surface browning because its increase is associated with an increase of surface browning in fruits such as apple or pear (Arias *et al.* 2008; González-Buesa *et al.* 2011); in our work, only cvs Ryan Sun and O'Henry showed an increase (Figure 1). Therefore, some surface browning was found for these

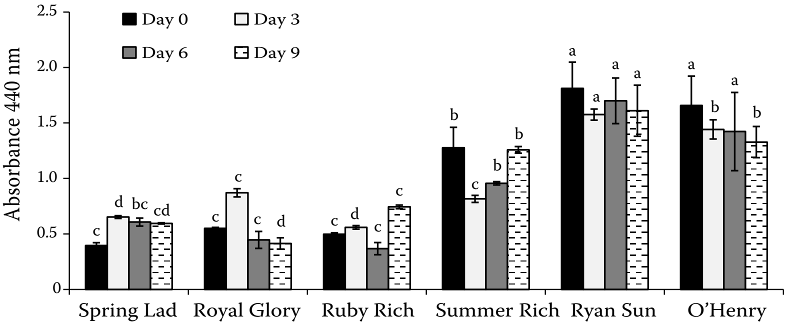

Figure 2. Browning potential (abs 440 nm) in the minimally processed peach cultivars stored for 9 days at 4°C

Data shown mean and standard deviation ($n = 4$); vertical bars for a same day followed by different letters indicate that the mean values are statistically different by Tukey's test ($P < 0.05$)

cultivars. The b^* value decreased for all cultivars, i.e. they suffered some discoloration process possibly due to phenolic degradation taking part on tissues.

Browning potential. Cultivars showed very different BP values (Figure 2). Cvs Ryan Sun and O'Henry had the highest values, and this was consistent with colour results. This high BP may be due to their high TPC and PPO activities, since both of them are said to be the main factors responsible for enzymatic browning. A certain correlation between these parameters was observed by some authors on peach (Lee *et al.* 1990), apple (Murata *et al.* 1995) and pear (Arias *et al*. 2008). However, other authors have not found this relation (González-Buesa *et al.* 2011). For all cultivars, except cv. O'Henry, BP suffered rises and falls throughout storage (Figure 2). However, it has been shown that the rate of browning of fruit products depends on the nature, concentration and interaction of the phenolic compounds that are co-present in tissues (Lee *et al.* 1990). This would be the reason why there may be differences in behaviour between cultivars.

Total phenolic content. There were significant differences between cultivars in TPC. Ryan Sun and O'Henry, both late cultivars, showed the TPC much higher than the rest, especially cv. Ryan Sun (Figure 3). Cvs Royal Glory, Ruby Rich, and Summer Rich showed increases of phenolic content during storage (Figure 3). These increases might be the response of plant tissues to stress suffered during processing (Haminiuk *et al.* 2012), because mechanical damage provokes *de novo* synthesis of the enzyme phenylalanine ammonia-lyase (PAL; EC 4.3.1.5), which is the key enzyme in phenolic biosynthesis (Tomás-Barberán & Espín 2001). However, for the rest of the cultivars, no trend was observed, especially for cvs Ryan Sun and O'Henry, whose TPC evolution was irregular, with a considerable decrease between day 3 and 6 for cv. Ryan Sun and between day 6 and 9 for cv. O'Henry. This fact could be explained by different rate of phenolic synthesis (due to stress) and degradation (due to PPO activity and surface healing). Thus, depending on the cultivar and tissue, different evolution during storage could be expected, with alternative dominance of phenolic synthesis and degradation (Fernando Reyes *et al.* 2007). Many authors have studied and analysed the relationship between phenolic compounds, PPO and enzymatic browning in fruits such as apple (Murata *et al.* 1995), pear (Arias *et al*. 2008), and peach (Lee *et al.* 1990; Cheng & Crisosto 1995; González-Buesa *et al.* 2011), however, this issue remains unclear today. In our case, it can be seen that BP and TPC data are consistent for all cultivars, i.e. higher phenolic content entails higher BP, except for cv. Summer Rich, which had a high BP in spite of having a low phenolic content.

PPO activity. The results were quite similar to those found for whole peaches (Lee *et al.* 1990). Cvs Summer Rich, Ryan Sun and O'Henry were the cultivars that showed the highest enzymatic activity (Figure 4). These results are consistent with those

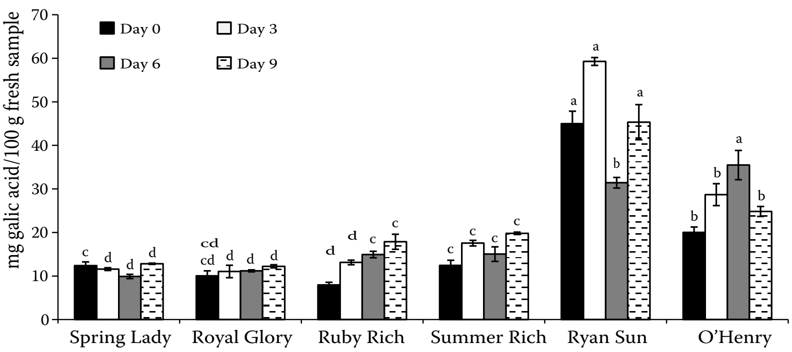

Figure 3. Total phenolic content (mg galic acid/100 g) in the minimally processed peach cultivars stored for 9 days at 4°C

Data shown mean and standard deviation ($n = 4$); vertical bars for a same day followed by different letters indicate that the mean values are statistically different by Tukey's test ($P < 0.05$)

Table 2. Lightness and hue angle values for fresh-cut peach cultivars stored for 9 days at 4°C

Day	Spring Lady	Royal Glory	Ruby Rich	Summer Rich	Ryan Sun	O'Henry
L*						
0	69.60^{d}	70.98^{d}	71.15^{d}	74.05^{d}	76.32^{b}	77.03^{d}
3	76.01^{c}	75.24^{c}	75.43^{a}	75.22^{a}	76.37^{a}	77.64^{c}
6	77.01^{a}	75.37^{b}	75.23^{b}	76.26^{b}	75.44^{d}	78.54^{b}
9	76.99^{b}	77.37^{a}	74.37^{c}	77.51^{c}	75.83^{c}	79.02^{a}
h°						
0	96.21^{d}	98.95^{d}	94.95^{d}	94.17^{d}	96.16^{a}	96.87^{a}
3	99.31^{b}	100.71^{c}	98.92^{c}	98.42^{c}	94.99^{b}	95.85^{b}
6	99.49^{a}	101.38^{b}	99.42^{b}	98.92^{b}	93.69^{d}	95.85^{d}
9	98.79^{c}	101.94^{a}	100.03^{a}	99.24^{a}	94.51^{c}	96.30^{c}

*L** – lightness. *h*° – hue angle; in each column values for a same cultivar followed by different letters show significant differences by Tukey's test ($P < 0.05$) ($n = 20$)

obtained in BP and TPC, except for cv. Summer Rich, which had moderately high BP and low TPC. The case of cv. Spring Lady is also noteworthy, since it had a relatively higher PPO activity in spite of having low BP and TPC. On the other hand, the evolution of enzymatic activity was very variable (Figure 4), probably due to inaccurate measurements that might have contributed to a large analytical error. Other studies have shown similar trends during storage of minimally processed peach (González-Buesa *et al.* 2011). This behaviour could be due to the decompartmentalisation of latent forms of PPO, which occurs for the cell lysis favouring the contact of enzyme and substrate. Moreover, it has been seen that the degree of latency can vary widely among species and tissues (Tomás-Barberán & Espín 2001).

Correlation coefficients between parameters. Relationships between all studied variables were assessed by using the Pearson test. Generally, it may be said that BP was correlated with all parameters to a greater or lesser extent ($P < 0.01$) except with those that were related to acidity (Table 3). In some cases, such as the relationship between BP and TPC, this correlation was stronger (0.762**), whereas its relationship with *L** or PPO was weaker (0.442** and 0.476**, respectively). The same pattern appears in TPC. The relationship between TPC and TSS (0.717**) was noteworthy, where cultivars (Ryan Sun and O'Henry) with the highest content of TSS during the whole storage would have the highest phenolic content. Surprisingly, there was not a close relationship between TPC and PPO. In fact, it was one of the weakest relations, which makes us think that the oxidation of phenols, causative browning, would be caused by other factors besides by PPO.

Principal component analysis (PCA). A principal component analysis (PCA) was used to explore relationships between the studied parameters, as well as the sample location in principal components 1 and 2 of space (PC1 and PC2, respectively), which accounted for 69.62% of the original data variability (Figure 5). On the one hand, PC1 explained 39.29% of data and was strongly influenced by BP and colour parameters *a** and *h*°, and in a weaker way by TSS, TPC and *b** (Figure 5a). On the other hand, PC2 explained 30.34% of variability. This was strongly influenced by TA, TSS/TA and pH. At an intermediate point in the space were *L** and PPO and this could be due to the fact that both parameters were explained by a third component, suggesting a weak

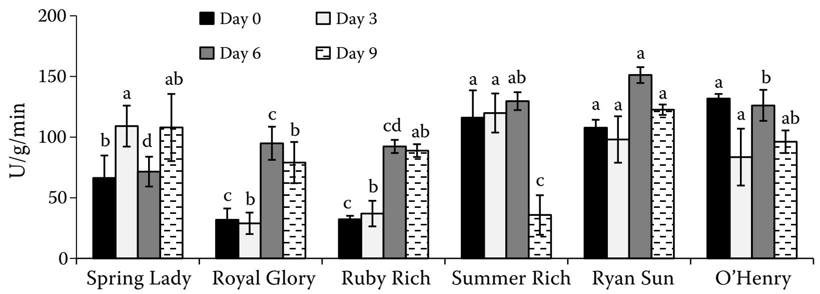

Figure 4. PPO activity (U/g/min) in the minimally processed peach cultivars stored for 9 days at 4°C

Data shown mean and standard deviation ($n = 4$); vertical bars for a same day followed by different letters indicate that the mean values are statistically different by Tukey's test ($P < 0.05$)

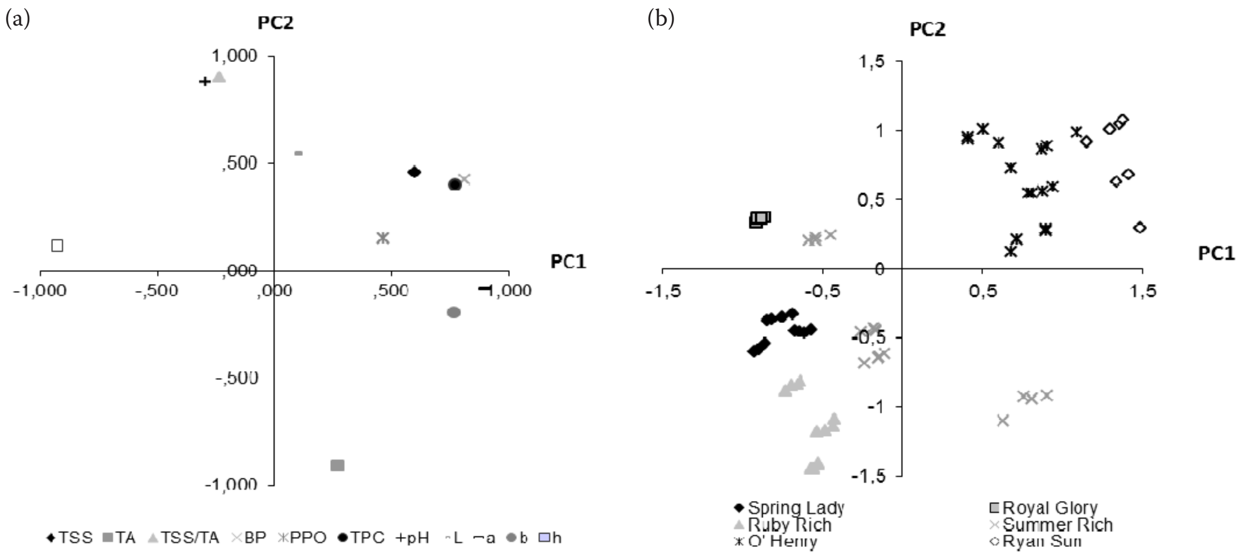

Figure 5. Principal component analysis of minimally processed peach cultivars (69.62% of data; PC1: 39.29%, PC2: 30.34%), for (a) the paramaters and (b) peach cultivars in study.

influence on the rest of the parameters. These results confirm again the close relationship between BP, colour parameters and TPC.

When samples were plotted on the plane defined by PC1 and PC2 (Figure 5b), cvs Ryan Sun and O'Henry were located on the positive side of PC1 axis. These were the cultivars with the highest values of BP, TPC (Table 3) and TSS content (Table 1) and with an increase in *a** value during storage (Figure 1). In contrast, cultivar Royal Glory was just located in the opposite area of the same axis (negative side). Cvs Spring Lady and Summer Rich were located in the negative side of the PC1 and PC2 axes, because both cultivars showed a decrease of *a** from day 0 to day 3 of storage, although cv. Summer Rich was located in the positive side of PC1 axis and in the positive side of PC2 axis too, indicating that this behaviour was due to the interaction of several factors including BP, TPC, and TA. Finally, Ruby Rich was located in the most negative side PC2 axis, indicating that this cultivar was strongly influenced by TA and inversely by TSS/TA and pH.

The disposition of cultivars on the plane makes us think that the cultivars that had a positive PC1 value related to the parameters involved in browning are not recommendable for minimal processing. According to these results, TA, BP, TSS, TPC and colour parameters *h*° and *a** are useful for fresh-cut peach characterisation.

Table 3. Pearson correlation coefficients between physicochemical and functional parameters

	TSS	TA	TSS/TA	pH	*L**	*a**	*b**	*h*°	BP	TPC	PPO
TSS	–	ns	0.389**	ns	ns	0.380**	0.488**	–0.419**	0.610**	0.717**	ns
TA		–	–0.909**	–0.918**	–0.395**	0.246*	0.335**	–0.283**	ns	ns	ns
TSS/TA			–	0.919**	0.230**	–0.245*	–0.219*	0.265**	ns	ns	ns
pH				–	0.239**	–0.245*	–0.336**	0.287**	ns	ns	ns
*L**					–	ns	–0.224*	NS	0.442**	0.352**	0.375**
*a**						–	0.652**	–0.988**	0.640**	0.584**	0.393**
*b**							–	–0.756	0.516**	0.380**	ns
h°								–	–0.653**	–0.580**	–0.356
BP									–	0.762**	0.476**
TPC										–	0.404**

TSS – total soluble solids (°Brix); TA – titratable acidity (% malic acid); TSS/TA – acceptability index; *L** – lightness; *a** – coordinate chromaticity; *b** – coordinate chromaticity; *h*° – hue angle; BP – browning potential (absorbance 440 nm); TPC – total phenolic content (mg galic acid/100 g fruit); PPO – polyphenol oxidase activity (U/g/min); *$P < 0.05$;**$P < 0.01$; ns – not significant

CONCLUSION

It can be concluded that cvs Ryan Sun and O'Henry are the cultivars that offer the least suitable fruit for fresh-cut processing, mainly due to their high BP and PPO activity, related to *a** increase and *L** decrease, respectively (undesirable attributes for minimal processing that might imply visual quality loss). Nevertheless, the high phenolic content of this cultivar does not necessarily rule it out from minimal processing. It may be that additional barrier techniques need to be applied. Further studies should include firmness of fruit slices and sensory analysis, paying attention to firmness and surface dehydration.

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