# Taste Panel Quality Evaluation of 'Hayward' Kiwifruit of Different Origins

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**Keywords:** *Actinidia*, Portuguese kiwifruit, appearance, flavour, sweetness, texture, consumer preference

**Abstract**

**In Portugal, the regions of Entre-Douro e Minho and Beira Litoral have exceptional conditions for the production of good quality kiwifruit. However, demand exceeds local supply resulting in importation of kiwifruit from Italy, Chile and New Zealand.**

**Taste panels were run in December, May and June to study the preferences of Portuguese consumers for 'Hayward' kiwifruit. In December, a comparison was made between kiwifruit from Portugal and Italy, in May between kiwifruit from Portugal and Chile and in June between kiwifruit from Portugal, Chile and New Zealand. Attributes assessed by panellists were: appearance, texture, flavour, sweetness and acidity. The same samples were analyzed for: weight, equatorial and longitudinal diameter, firmness, soluble solids (as measured by refractometer) and titratable acidity.**

**In May, panellists preferred Portuguese kiwifruit, but in December and June the preference was not so clear. In December, Portuguese kiwifruit were not at the eating ripe stage and in June they were at the end of their storage life (bad appearance but better flavour, sweetness and texture).**

## INTRODUCTION

In Portugal, kiwifruit production started to become important from the 1980s. Currently, the area planted is about 1000 ha with a total production of 10,500 tonnes, with both area and production still increasing. Cultivation is concentrated in two regions that have exceptional conditions for kiwifruit production and quality: in the north, the region of Entre Douro e Minho; and in the centre, the region of Beira Litoral. Production is almost exclusively of the cultivar 'Hayward' because of its longer storage life and its larger fruit size (G.P.P.A.A., 2002).

The period of harvest and national sales of kiwifruit starts in the second fortnight of November and continues until the end of May. According to Veloso (2002), annual consumption in Portugal of kiwifruit is about 20,000 tonnes of which half is imported because local production is not sufficient. The biggest volume of imports is in May-June and September. Most of these imported kiwifruit come from Spain (41%), Chile (16%), Italy (13%), France (9%) and Germany (8%) (G.P.P.A.A., 2005). From November until the beginning of May, the kiwifruit sold in Portugal is essentially of European origin. From then on, the supply of locally-produced kiwifruit is reduced and kiwifruit from Chile and New Zealand start to be sold.

Comparative evaluation of kiwifruit of different origins that are simultaneously available in the market could provide useful information by which the quality of locally produced kiwifruit could be assessed and benchmarked. Increasing international competition indicates a need to produce a distinct product for its quality.

In Portugal, commercial operators are already requiring certification of the product. There is increasing pressure from distribution companies to establish quality criteria for the fruit.

Evaluation of quality is complex and some of the attributes that need to be taken into account include: visual appearance, texture, flavour, nutritional value and security.

Each of these attributes counts in a series of components.

According to Kleiber (1995), evaluation of kiwifruit quality can be made by considering weight and shape of the fruit, by quantification of soluble solids through the refractometric index (IR-ºBrix (%)), a starch test, flesh firmness, titratable acidity, dry matter and mineral composition.

In accordance with some authors (Almeida, 1996; Bretaudeau and Fauré, 2002; Kleiber, 1995; Veloso, 2002), kiwifruit reach acceptable quality and possess better storage capacity when the soluble solids content at harvest is 6.2%. Kleiber (1995) and Tonini (1997) state that to guarantee a good organoleptic quality when fruit are eating ripe, kiwifruit must reach 13–14% ºBrix and a flesh firmness between 0.5 and 1.5 kg/0.5cm$^2$.

Eating a fruit provides a symphony of sensory sensations (Pinon, 1998). For consumer preferences the balance between acidity and sweetness are determinant factors in these sensations, affecting the simultaneous appreciation with other components, among them the volatile substances (Namesny, 2002). Usually a consumer does not explain the reasons for the degree of satisfaction, but either likes or does not like a product (Pinon, 1998).

The objective of this work was to compare consumers' perceived satisfaction of kiwifruit produced in Portugal with their perceptions of imported kiwifruit.

## MATERIALS AND METHODS

A panel of 15 people (male and female, with ages between 19 and 55 years) was selected from 1200 people (students, professors and employees) of a School of Superior Education of Agriculture in Portugal. All panellists were habitual consumers of kiwifruit and liked them.

Samples of fruits were analysed on 3 dates with fruit that were simultaneously marketed in Portugal:

In December, the comparison was between kiwifruit from Portugal and Italy. The fruit were at a similar state of ripeness; time of harvest is the same in both countries and the storage techniques are similar;

In May, the comparison was between kiwifruit from Portugal and Chile. The kiwifruit produced in Portugal had been stored for 6 months (0ºC and relative humidity of about 90–95%), and those from Chile for 1 month, the latter being less ripe.

In June, the comparison was between kiwifruit from Portugal, Chile and New Zealand. Kiwifruit produced in Chile and those from New Zealand were at a similar stage of ripening: they had been in store for 2 months, whereas fruit from Portugal were at the end of their storage life (7 months after harvest).

Panellists evaluated the following attributes: external appearance, texture, flavour, sweetness and acidity, in an increasing scale from 1 to 5. Scores for quality were established according to a scale from 0 to 20. The same samples were evaluated in the laboratory for: weight (g), equatorial diameter (mm), length (mm), soluble solids (ºBrix) also called refractometric index (RI - %), titratable acidity (g/L citric acid) and firmness (kg/0.5cm$^2$).

## RESULTS

In December, panellists did not show preferences between the two samples from Portugal and Italy (Fig. 1A). They considered that fruit produced in Portugal had a better appearance, but were slightly more acid and less sweet than those from Italy (Fig. 1B).

Laboratory analyses confirmed that compared with Italian fruit, Portuguese kiwifruit had higher ºBrix, but also higher titratable acidity, which masked the sweet taste (Fig. 2A). It was also confirmed that the softer fruit had the better texture (Fig. 2B).

In May, panellists preferred fruit produced in Portugal: they were in good eating ripe condition being sweeter, with better flavour, better texture and better appearance than those from Chile that had not reached the accepted eating ripe condition (Figs. 3 and 4). In June the Portuguese fruit were at the end of their storage life. However they had a

similar score (panel test) to fruit from other countries (Fig. 5 A). Panellists classified the kiwifruit produced in Portugal as having a better flavour, better sweetness and better texture but poor appearance compared with fruit from the other two countries (Fig. 5 B). Laboratory analyses showed that Portuguese fruit were softer with less acid. Soluble solids were similar in the three samples (Fig. 6 A and 6 B).

## DISCUSSION

Understanding the perception of taste of consumers is not an easy task. Portuguese consumers seem to like kiwifruit with: firmness between 0.5 and 1.9 kg/0.5 $cm^2$ and soluble solid concentration over 12%, values already described by Kleiber (1995) and Tonini (1997), as indicators of good eating ripeness.

According to Namesny (2002), many other components contribute to the preference of the consumers; only by understanding these can we explain the decisions of the panellists.

From our results, it seems that Portugal produces kiwifruit of good quality which can be marketed from harvest (end of November) to June. As it is necessary to promote the Portuguese fruit in May and June, towards the end of their storage life, they should be promoted for their good eating ripe condition which should make them more tempting to the consumers.

If Portuguese production of kiwifruit increases, we believe that there will be no marketing problems as the Portuguese fruit are already well accepted by potential consumers.

## ACKNOWLEDGEMENTS

This work was supported by Project "Demonstração e promoção de práticas agrícolas que assegurem a qualidade e segurança alimentar e que minimizem o impacto ambiental da cultura da Actinidea." Programa AGRO / Medida 8 /nº 688.

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## Figures

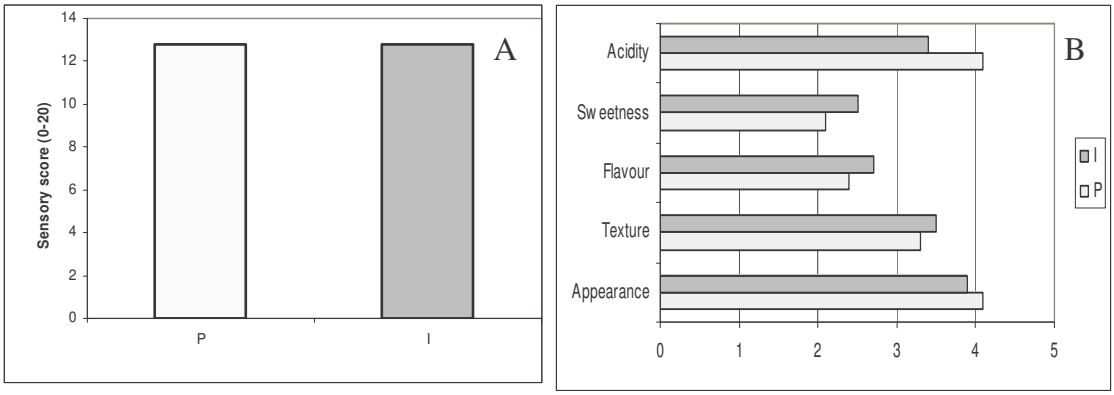


Fig. 1. Sensory score (A) and quality attributes of 'Hayward' kiwifruit from Portugal and Italy evaluated by the panellists (B) in December. I, Italy; P, Portugal.

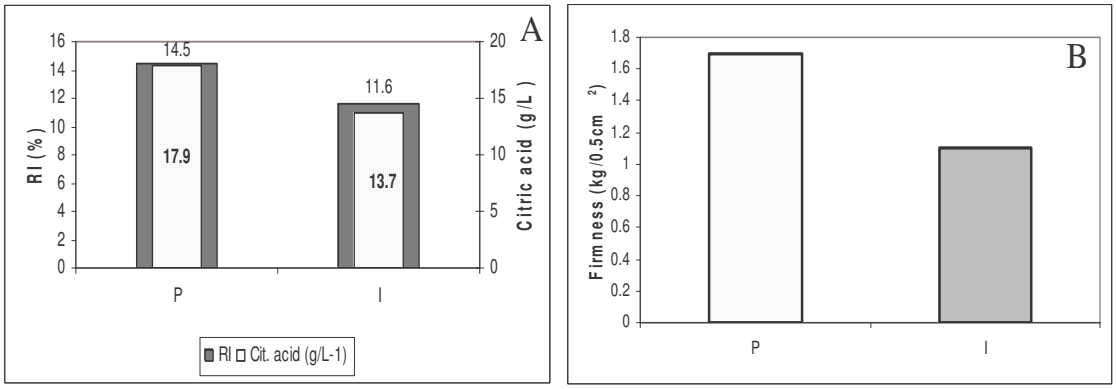


Fig. 2. Soluble solids and titratable acidity (A) and firmness (B) in samples of 'Hayward' kiwifruit in December. I, Italy; P, Portugal.

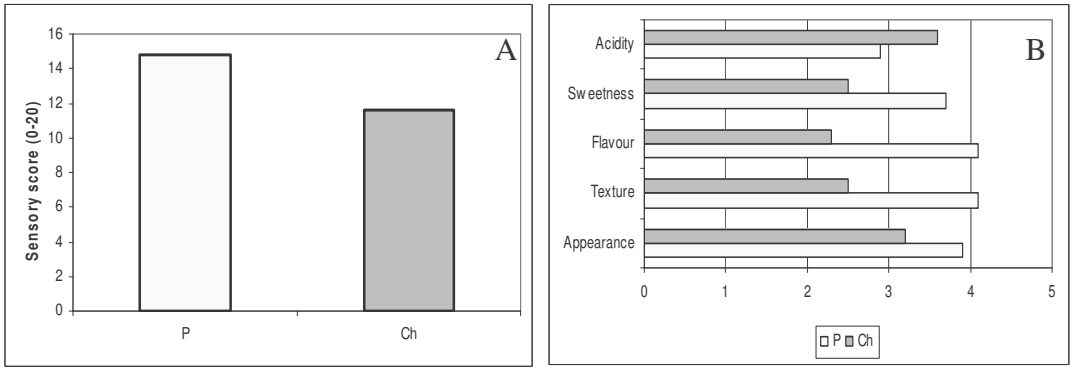


Fig. 3. Sensory scores (A) and quality attributes of 'Hayward' kiwifruit evaluated by the panellists (B) in May. Ch, Chile; P, Portugal.

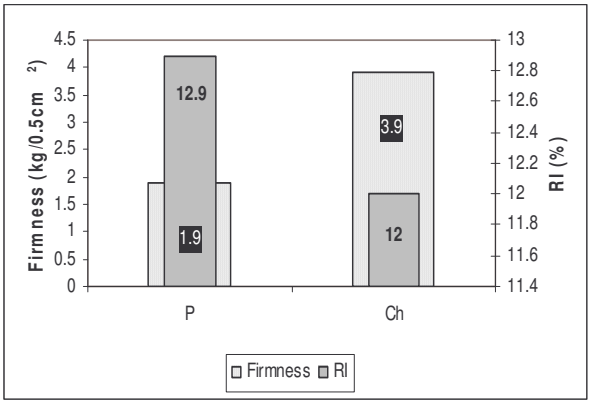


Fig. 4. Firmness and soluble solids in samples of 'Hayward' kiwifruit in May. Ch, Chile; P, Portugal.

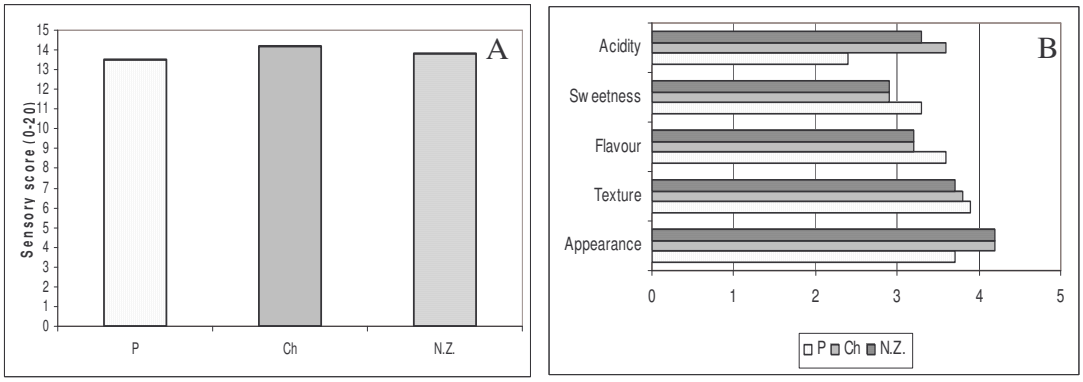


Fig. 5. Sensory scores (A) and quality attributes of 'Hayward' kiwifruit evaluated by the panellists (B) in June. Ch, Chile; NZ, New Zealand; P, Portugal.

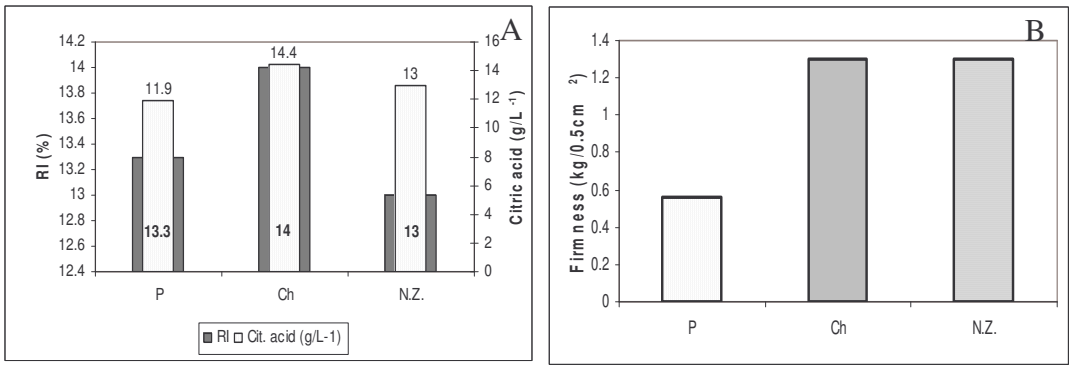


Fig. 6. Soluble solids and titratable acidity (A) and firmness (B) in samples of 'Hayward' kiwifruit in June. Ch, Chile; NZ, New Zealand; P, Portugal.