

# The Influence of Cultivation and Cultivar on Sensory Profiles of Fresh Strawberries and their Purées

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## Summary

Sensory quality is important in assessing cultivars for fresh consumption as well as for the processing industry. Important quality attributes for fresh consumption were found to be colour, taste, flavour and texture attributes. Strawberries (*Fragaria x ananassa* Duch.) have unique, highly desirable taste and flavour and are one of the most important cultivated berry fruits in Croatia. Today, consumers are increasingly better informed about diet and health, and as a result, desire more “healthy” food, which offer high quality, safety and optimum nutrient balance. The increasing demand for organic food has focused interest based on claims that an organic product tastes “different”, is “preferred” and is “more healthy”. It has implicit expectation that the improvement is due to the way the food is grown. The topic of organic food and organic agriculture attracts considerable public, commercial and research interest. The purpose of the present investigation was to profile the sensory characteristics of fresh fruit and its purées in two strawberry cultivars, ‘Maya’ and ‘Queen Elisa’, conventionally and organically grown in Croatia.

Quantitative descriptive analysis (QDA) was used to describe the sensory properties of fresh fruit as well as its purées. All obtained results were statistically evaluated.

Conducted sensory evaluation indicated that there were slightly expressed some differences in sensory attributes observed by panelists between two different cultivars and two type of cultivation but they did not show significant differences in any sensory attribute when dealing with two different strawberry cultivars or two types of cultivation.

## Key words

strawberry, organic cultivation, conventional cultivation, sensory evaluation

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## Introduction

Strawberries (*Fragaria x ananassa* Duch.) are unique with highly desirable taste and flavour. They are excellent dietary sources of ascorbic acid, potassium, fibre and other secondary metabolites and also simple sugar sources of energy (Pérez et al., 1997; Wang et al., 2002). Like other fruits, strawberries can be consumed as fresh fruit, which turns out to be advantageous to consumers since there are no nutritional losses due to processing. On the other side, the preference for fresh fruits is challenging because they have a very short shelf-life, due to their sensitivity to fungal attack and excessive softening caused by the natural ripening process. The colour of the fruit plays an important role in its sensory appreciation, with a good colour increasing acceptance and the perception of other attributes such as taste and texture (Clydesdale, 1984).

Sensory testing has been taking place ever since there have been humans around to assess the quality of their surroundings. Sensory analysis is defined as a scientific discipline of highlighting and describing the sensory properties that are perceived by sense organs. It comprises the perception of the presence, or intensity of perceived properties, or the differentiation of perception and quantitative assessment. There are many kinds of tests that are given to evaluate sensory perceptions of a product. Descriptive sensory analysis is the most sophisticated sensory method. It is used to identify and quantify the sensory characteristics of products, usually in the order of their occurrence, through the objective descriptions of trained assessors who possess extraordinary sensory perception (Drake and Civille, 2002). Sensory quality is important in assessing cultivars for fresh consumption as well as for the processing industry (Skrede, 1980; Skrede, 1982; Stanely, 1986; Stanely, 1988). Important quality attributes for fresh consumption are colour, taste, flavour and texture attributes. The quality of processed fruits differs considerably from that of fresh fruits, though the aim of the industry is to conserve the quality of fresh fruits in the best way.

Observation of consumer expectations of food quality presents the base for any successful food production and marketing. This is also true for fruits and vegetables, which are increasingly valued as an important part of the diet which strawberries certainly are. Today's consumers are discerning, demanding and more knowledgeable about food and expect products which are safe, good value, optimum nutrient balance and of high sensory quality (Abdullah and Cheng, 2001). Consumer attitudes to foods are mainly influenced by quality attributes. It is widely accepted that consumer acceptance of foods is mainly determined by their sensory perception since the sensory testing places worth on a product and helps to determine its acceptability in the marketplace. A survey

conducted in the European Union countries showed that the primary factor influencing food choice of European consumers was quality/freshness followed by taste, healthy diet, price, family preferences and habits (Lappalainen et al., 1998; Lennernas et al., 1997).

Last few years, organic food and organic agriculture attracts considerable public, commercial and research interest (Bourn and Prescott, 2002). Organic food is food produced according to organic standards, which means crops grown without the use of conventional pesticides, as well as artificial fertilizers or sewage sludge, animals reared without the routine use of antibiotics and without the use of growth hormones and food processed without ionizing radiation and without the use of a wide range of food additives. Historically, these farms have been small family-run farms. In Croatia organic foods are becoming much more widely available but only in small stores or farmers' markets. It is supposed, that higher nutrient availability and the lack of chemical plant protection in organic farming lead to different ripening processes and thus to a different composition of nutrients and other plant ingredients in organically grown and produced feedstuff (Brandt and Mølgaard, 2001). As the demand for organic foods has grown globally, disputes have arisen on whether organic foods are more nutritious, safer and better for the environment. To many consumers a major issue is whether organic foods taste different and, especially if they are being asked to pay a premium price, whether they taste better.

During the last decade strawberry production has spread throughout almost all parts of Croatia. Although comparisons between organic and conventional foods have been reported for a range of attributes, the purpose of the present investigation was to characterise the sensory quality of currently grown strawberry cultivars in Croatia, conventionally and organically cultivated and to compare the sensory quality of freshly harvested fruit and its purées.

## Material and methods

### Strawberry samples

Fresh samples of conventionally and organically cultivated strawberry fruit (*Fragaria ananassa* Duch. cvs. 'Maya' and 'Queen Elisa') were hand-harvested at a commercially stage of maturity near Zagreb. Fruits were collected manually early in the morning and brought by car to the Sensory laboratory within four hours after harvest. At arrival, the fruit was manually washed, after dissection of stalks and elimination of damaged fruit. The strawberry purées were prepared from whole strawberries using commercial blender (Vaxy Zepter hand blender). Strawberry purées for sensory evaluation were prepared by blending

whole fruit using commercial hand blender (Vaxy Zepter). The fresh fruit as well as the purées, prepared for sensory evaluation, were kept at +4 °C until sensory analysis which was performed approximately six hours after harvesting.

### Methods

Sensory analysis of all samples of fresh strawberries and their purées was carried out by a trained panel consisting of ten to fifteen members per session. Their age ranged from 22-45 years old. The procedure was performed according to methods described in ISO 6564, ISO 8587 and ISO 11036 (in a sensory laboratory equipped according to ISO 8589). The vocabulary used in this evaluation was based on a vocabulary for analysis of fresh fruits and jams, previously used in the same laboratory. Sensory attributes include 14 descriptive terms to describe the colour, flavour, odour, taste, texture and appearance. Attributes evaluated are shown in Table 1.

**Table 1.** Descriptive sensory vocabulary for fresh strawberries and their purées

Fresh samples		Pureés	
Colour	intensity	Colour	intensity
Flavour	fruity	Flavour	fruity
	flowery		flowery
	greeny		greeny
	earthy		earthy
Odour	off flavour	Odour	off flavour
	intensity		intensity
	off odour		off odour
Taste	sour	Taste	on strawberry
	sweet		sour
	harmonic		sweet
Texture	firmness	Appearance	harmonic
	floury		homogeneous
	aqueous		viscous

Three fresh fruit samples were served in two replicates on small white porcelain plates. Strawberry purées, approximately 30 g, were served in transparent plastic glasses. All samples and replicates were coded with three digit random numbers and served in randomized order. The panelists rinsed the mouth with salt-free bread and water between each sample. The panelists scored the samples for every characteristic in the vocabulary, using a suitable scale from 1-7, to show the relative strength of each note, in which 1 indicated total absence of the sensory attribute and 7 a very definite attribute. The higher rating reflected good quality attribute (1 - dislike very much, 7 - like very much). Panelists were asked to evaluate the colour first, then the odour attributes and after that the texture with the spoon. After putting some sample in the mouth, they rated flavour attributes. Finally, after having swallowed the sample, they evaluated the taste attributes.

### Results and discussion

During this research, the samples of fresh strawberries as well as their purées were assessed using descriptive sensory analysis. The results of sensory evaluation for fresh strawberries and their purées were represented as spider's web plots, averaged across the panel (Figures 1-4). The intensity of certain property is the lowest in the center of the plot and the highest on the margins of the plot (Meilgaard et al., 1991). Samples of fresh fruit and purées of two different cultivars in two different cultivation types were considered as a source of variation. The results were statistically evaluated by analysis of variance (ANOVA). Statistically differences with *P*-values under 0.05 were considered significant.

This study aimed to investigate the relationship of objective quality measurements including sensory attributes and panelists' perception of two different strawberry cultivars conventionally and organically grown in Croatia.

The data in Figure 1 shows the spider's web plot for fresh strawberry samples of Maya cultivar conventionally and organically cultivated. Conventional samples had a deeper red colour and more expressed fruity flavour. Odour intensity was stronger expressed just as aqueous texture. Organic 'Maya' strawberries had more expressed harmonic taste. They were sweeter and sourer in taste compare to conventional samples. They also had more firm texture. Greeny, earthy, flowery, floury texture, off-flavour as well as off-odour were equally slightly expressed in conventional and organic cultivated samples.

Spider's web plot for strawberry pureés of Maya cultivar conventionally and organically cultivated is showed in Fig 2. Conventional samples had slightly higher colour intensity and were sourer in taste. Also, homogeneity was better in conventional samples. Organic pureés had slightly better expressed fruity flavour, strawberry and odour intensity. In addition, organic samples were sweeter and more harmonic in taste than conventional. Flowery, greeny, earthy, off-flavour and off-odour were equally slightly expressed in both samples. Viscosity was about equally expressed in both samples.

Figure 3 shows spider's web plot for fresh strawberry samples of Queen Elisa cultivar conventionally and organically cultivated. Conventional strawberries were higher scored for colour intensity, fruity flavour, odour intensity and firm texture. Comparing to conventional, organic strawberries were more harmonic in taste with little more expressed sourness while sweet taste was almost comparably expressed in both cultivated strawberries. Flowery, greeny, earthy, off-flavour, off-odour and floury texture were inconsiderably expressed in both samples, conventional and organic.

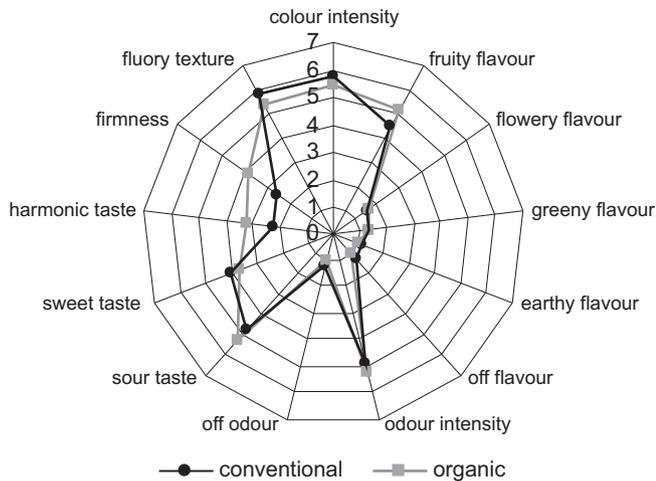


Figure 1. Spider's web plot for fresh strawberry samples of Maya cultivar conventionally and organically cultivated

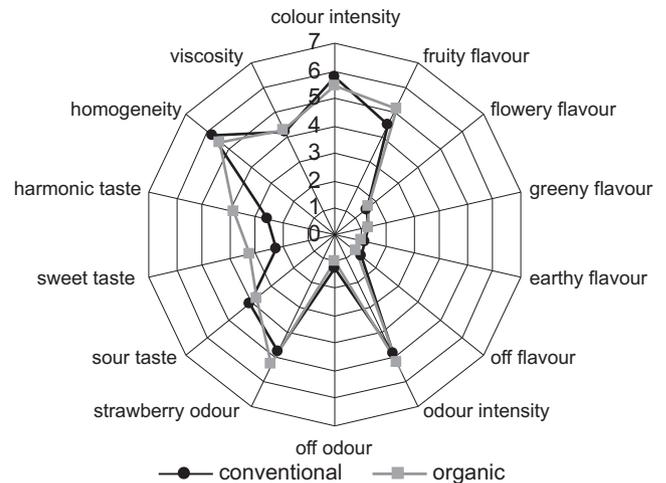


Figure 2. Spider's web plot for strawberry pureés of Maya cultivar conventionally and organically cultivated

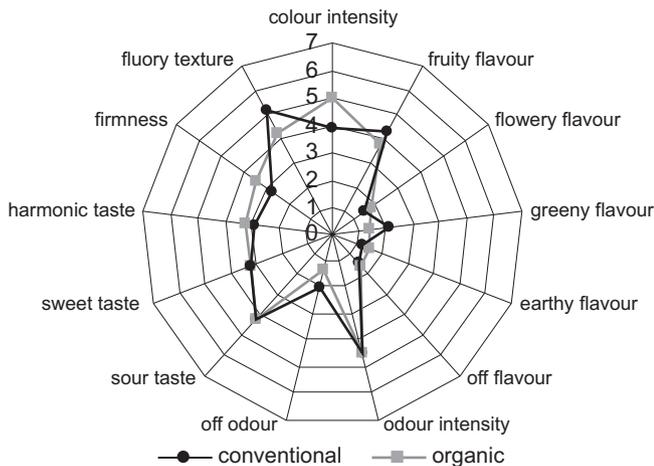


Figure 3. Spider's web plot for fresh strawberry samples of Queen Elisa cultivar conventionally and organically cultivated

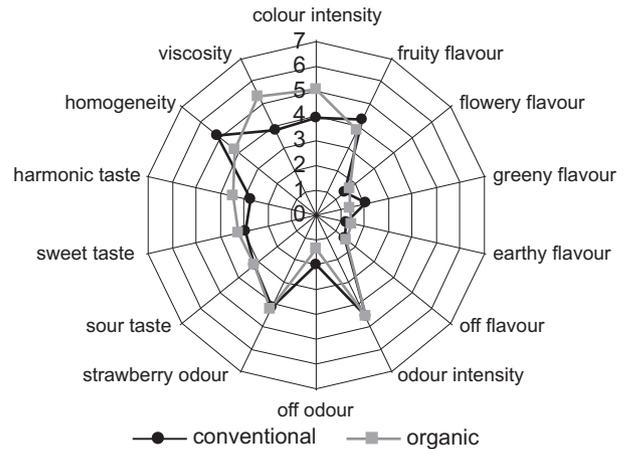


Figure 4. Spider's web plot for strawberry pureés of Queen Elisa cultivar conventionally and organically cultivated

Spider's web plot for strawberry pureés of Queen Elisa cultivar conventionally and organically cultivated is showed in Figure 4. Conventional pureés had more intensive fruity and greeny flavour. Furthermore, conventional pureés were more homogenous so they were higher scored for homogeneity. Organic pureés had intensive marked red colour, sweeter taste and more expressed harmonic taste compared to conventional samples. Higher viscosity was also observed in organic samples. Moreover, flowery, earthy and off-flavor, strawberry odour and odour intensity were the equally expressed in both samples, organic and conventional.

Galletta and Maas (1990) showed that different cultivars had different taste which is in accordance with obtained

results. Regarding to differences between cultivars in certain cultivation type it was observed that fresh samples of conventionally and organically grown 'Maya' had more expressed sourness and aqueous texture while 'Queen Elisa' samples had more expressed fruity flavour, sweet taste and firm texture. Among obtained pureés 'Maya' samples, conventionally and organically grown, had deeper red colour, more expressed odour intensity and strawberry odour. Moreover, sour taste and homogeneity was also more expressed in comparison to 'Queen Elisa' which had more expressed off-flavour. However, statistical analysis of these sensory data did not show significant differences in any sensory attribute when dealing with two different strawberry cultivars or two types of cultivation.

## Conclusion

Via the use of sensory analysis using trained panellists and quantitative descriptive analysis research was carried out to determine whether the claim of “organic food tastes better” could be verified. These results led to the conclusion that the panel was able to detect differences in taste related to different cultivars or different cultivation. In that way conducted sensory evaluation indicated that fresh conventional strawberries rated higher in colour and odour intensity without marked differences between cultivars while organic strawberries had slightly more expressed harmonic taste. Furthermore, organic purées had more expressed fruity flavour and strawberry odour as well as harmonic taste and viscosity, while conventional purées had deeper red colour in comparison with fresh organic fruit. In addition fresh strawberries had many of the same sensory characteristics as their purées.

The study showed that conventional and organic strawberries as well as their purées were perceived as tasting good; however, no remarkable differences were found between two different cultivars. Therefore, it is concluded that the global claim that “organic food tastes better” is not valid, and each product type should be treated separately before a claim can be made.

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