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THEORETICAL RESEARCH ON THE QUALITY PARAMETERS OF FRESH STRAWBERRIES

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Abstract: *The paper presents some theoretical aspects regarding the quality parameters of strawberries. These are the first fruits that appear in spring and are highly sought after for their rich content in: sugars 4.5-9.5%, organic acids 0.72-1.91%, protein 0.10-0.51%, mineral salts 0.94-1.74%, vitamin C 42-106 mg%, vitamins A, B1, B2, PP. Strawberries are part of the category of extremely perishable fruits and are distinguished by a low structo-textural firmness, delicate tissues, thin skin, high water content. Intense respiration and a large surface area of contact with the environment, so the duration of maintaining their quality, even in optimal conditions of temperature and relative humidity of the air, is 2-5 days. They are very sensitive to high temperatures and pressures that occur during harvesting, handling, storage.*
Keywords*: quality parameters, fresh strawberries.*

1. INTRODUCTION

Quality is a complex notion that encompasses both the properties of the product to satisfy a certain need and economic aspects related to the realization and use of the product.
The quality of a product is determined by all its characteristics and can be observed, measured or compared with a standard. The properties of the products are numerous, but only some of them determine, at a certain moment, the quality.
In order to assess the quality of the strawberries, different specific criteria are used, which highlight the most important characteristics according to which their quality is established, according to the normative acts in force.
According to these normative acts, the quality is differentiated by quality categories or classes: extra, quality I and quality II.
In order to establish the properties that underlie the assessment of fruit quality, sensory and laboratory analyzes are performed (for physical and chemical properties). Organoleptic analyzes performed with the help of the senses are easy and quick [3].
To assess the quality of fresh strawberries, the following characteristics are taken into account: shape, size, appearance of the epidermis and core, consistency, taste, pulp juiciness, authenticity of the variety, freshness, health and cleanliness, degree of maturity.

- *The authenticity of the variety* is verified on the basis of typical characteristics (shape, size, appearance of the skin, pulp consistency, type and number of seeds, etc.) by comparison with the varieties in the reference samples;
- *The shape* varies depending on the species, variety, degree of maturation, environmental conditions, being given by nature plant organ (cylindrical, oval, spherical, etc.). Knowledge of the shape is important for preparing the conditions for packaging, sorting, calibration, transport, etc .;
- ***The size of the fruit*** can vary quite a lot depending on the pedo-climatic or technological conditions applied. These variations change the relationships between the structural parts of the fruit, changing the nutritional value and processing yields.

Size *is considered a quality criterion* for the marketing or industrialization of strawberries, sorting them and classifying them into quality classes that take into account the size of the fruit. Size is defined, as appropriate, by diameter, length, width, thickness, weight, volume, number of pieces per kilogram, etc .;

- *The color* is due to the presence of different pigments in the peel or even the pulp of the fruit. They are found in different proportions depending on the species, variety, agropedoclimatic conditions, degree of maturation. Also, the intensity of pigmentation can be influenced by some external factors such as light, temperature, humidity, soil nutrient profile.

The color serves to establish the authenticity of the variety and to evaluate the degree of maturity.

- *Structural-textural consistency or firmness* is the opposite resistance of the fruit to mechanical action,

and evolves as the fruit matures, decreasing towards the time of harvest. It is used to determine the time and manner of harvesting, packaging, transport, to determine the duration of storage in a fresh state and the method of industrial processing;

- *Taste* is one of the most important characteristics of fruits. He is specific to each species and variety, being determined by the content and ratio between carbohydrates, organic acids, etc .; The maximum intensity of the taste is obtained only if at harvest the fruits have reached the optimal degree of maturity which subsequently favors the biochemical processes responsible for perfecting the taste;
- *The succulence of the pulp* is conditioned by the degree of maturity, the state of turgidity, species, variety, conditions of harvesting and storage and is an important criterion for directing fruit for certain forms of consumption and industrial processing;
- The state of freshness is appreciated sensorially, according to the degree of turgidity, firmness and appearance, being determined by the duration and storage of the fruit;
- ***Health and cleanliness*** are very important quality conditions. Fresh fruits they must be healthy, free from disease or pests, clean, free of foreign matter;
- ***The presence of the peduncle*** is a quality characteristic for strawberries. Its absence allows loss of juiciness, damage to the integrity of the pulp and promotes faster deterioration of the fruit.

2. MATERIAL AND METHOD

The concept of quality is determined by the commercial appearance of fresh strawberries presented for sale, by their physical properties (freshness, size, shape and color, dry matter, product temperature) and their conditioning (sorting, packaging, storage, labeling and presentation).

Sorting is a very important operation that requires to be performed before packing and directing the products for storage. Its role is to separate the products into quality classes according to the general and specific properties provided by the standards.

The main purpose of packaging is to protect products against various degradation factors, as well as to facilitate handling, transport and storage operations.

The type and size of packaging used are consistent with the strength of the structure and the degree of perishability of the fresh fruit. The packaging used mainly in the case of strawberries is represented by crates, boxes made of wood or cardboard.

The duration and storage conditions of strawberries depend on their resistance to storage, the particularities of the chemical composition, the structural-textural resistance, etc. It should be borne in mind that, after harvest, these products continue their metabolic processes under the action of their own enzymes, which requires careful management of microclimate factors (temperature, relative humidity, light) in storage media.

Table 1: Storage conditions for strawberries

The product	Optimal temperature ºC	Relative humidity of the air	Maximum shelf life
Strawberries	0	85-90	3-5 days

The decrease of the storage temperature below 0ºC, triggers the freezing of the strawberries, and the high temperature favors the intensification of the metabolic processes and leads to their degradation.

During storage, periodic checks shall be carried out for the sorting and disposal of sick or spoiled specimens [2].

Strawberry growers must comply with the food safety requirements of both the country of production and the country of import.

The technical regulation aims to define the qualities that must be presented by strawberries of varieties from the genus Fragaria L., intended for delivery to consumers in a fresh state, after conditioning and packaging. These qualities are further exposed on the basis of strawberries of the Gariguette, Camarosa and strawberry varieties (Figure 1, 2, 3).

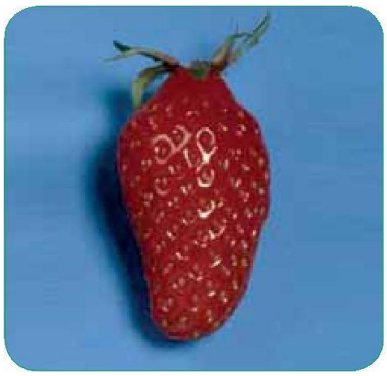

Figure 1: Gariguette variety

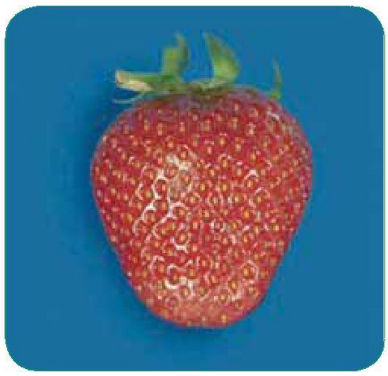

Figure 2: Camarosa variety

Figure 3: Wild strawberries

2.1. Minimum requirements

In all classes, subject to the special provisions for each class and the tolerances allowed, the strawberries must be:

- integers, figure 4;
- healthy (products affected by rot are excluded or products deterioration due to which they become unsuitable for consumption), figure 5-13; •
- clean, practically without visible foreign matter, figure 14;
- with a fresh but unwashed appearance, figure 15; •
- without diseases;•
- without damage caused by diseases, figure 17-18;
- with calyx (except wild strawberries);
- the calyx and peduncle, when present, must be fresh and green, figure 19-20;
- without abnormal external moisture;•
- without foreign smell and / or taste.

Figure 4: Minimum requirements - "Whole". Fruit hit / stung - it is not accepted

Figure 5: Minimum requirements - "Healthy" Fruit hit / stung hard. - it is not accepted

Figure 6: Minimum requirements -"Healthy". Unhealed cracks - it is not accepted

Figure 7: Minimum requirements "Healthy". Cracks from the rain - it is not accepted

Figure 8: Minimum requirements - "Healthy" Sunburn. - it is not accepted

Figure 9: Minimum requirements - "Healthy" The disease is caused by fungus Sphaerotheca Macularis F.C. Oidium fragariae - it is not accepted

Figure 10: Minimum requirements - "Healthy". Fruit mold Cladosporium – it is not accepted

Figure 11: Minimum requirements -"Healthy". Rhizopus - it is not accepted

Figure 12: Minimum requirements -"Healthy". Penicillium - it is not accepted

Figure 13: Minimum requirements - "Healthy". Botrytis on the fruit Immature - it is not accepted

Figure 14: Minimum requirements "Clean, practically devoid of bodies visible foreign bodies ". Earth on the fruit - it is not accepted

Figure 15: Minimum requirements - Fresh-looking but unwashed Aged fruit, without appearance - it is not accepted

Figure 16: Minimum requirements „Practically free of attacks of parasites ". Traces of damage caused by Thrips - it is not accepted

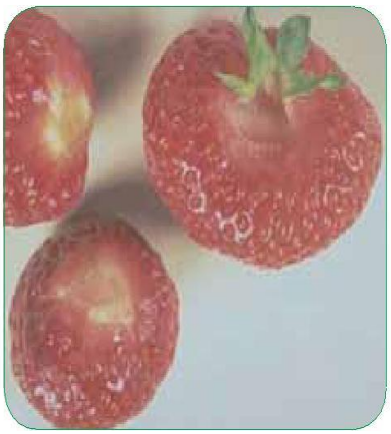

Figure 17: Minimum requirements With calyx (except wild strawberries) the calyx and when the peduncle is present, must be fresh and green Calyx and peduncle broken - it is not accepted

Figure 18: Minimum requirements With calyx (except wild strawberries) the calyx and when the peduncle is present, must be fresh and green Calyx and withered peduncle - it is not accepted

Figure 19: Lack of peduncle - it is accepted

Figure 20: Wild strawberries without calyx – it is accepted

Figure 21: Deformed fruit - it is not accepted

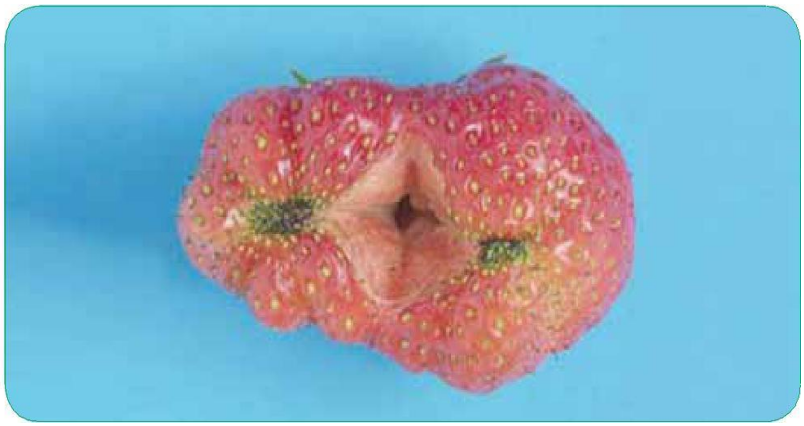

Figure 22: Deformed fruit – it is not accepted

The development and condition of the fruit must be such as to enable them:

- resistance to transport and handling;
- arrival in satisfactory condition at the place of destination.

Fruits with shape defects are not allowed (figure 21 - 22). The maturity of the strawberries must be within the norm. Unripe fruits (figure 24) and overripe fruits (figure 23) are not accepted. Strawberries fall into three quality categories: Extra category, category I and category II.

Figure 23: Overripe fruits - it is not accepted

Figure 24: Unripe fruit – it is not accepted

2.2. Extra category

Table 2: Quality characteristics and tolerances of Extra category strawberries

Extra category	
Characteristics of strawberries:	**Quality tolerances**
✓ must be of superior quality, characteristics of the respective variety; ✓ healthy appearance; ✓ not to show traces of earth; ✓ without defects, except for very small ones superficial alterations in the epidermis, provided that they do not affect the general appearance of the product, its quality, storage and presentation in the packaging (Figure 25-27).	- 5% by number or weight of strawberries not correspond to the characteristics of the category, but which comply with the characteristics of category I or are exceptionally allowed within the tolerances of this category; - within this tolerance, spoiled fruit is limited to 2%.

Figure 25: Strawberry variety Window - Extra category

Figure 26: Strawberry variety Gariguette - Extra category

Figure 27: Strawberry variety Camarosa - Extra category

2.3. Categoria I

Table 3: Quality characteristics and tolerances of category I strawberries

Category I	
Characteristics of strawberries:	**Quality tolerances**
✓ be of good quality; ✓ to present the characteristic coloration and	- 10% of the number or weight of strawberries does not conform to the characteristics of the class, but

shape variety. The following defects are allowed provided these do not affect the general appearance of the produce, the quality, the keeping quality and presentation in the package: - slightly defective shape (figure 28); - small white area not exceeding one tenth of the surface of the fruit (figure 29); - superficial signs of pressing (figure 30-31); - practically devoid of traces of earth (figure 32).	conforms to the characteristics of category II or is exceptionally allowed within the tolerances of that class; - within this tolerance, spoiled fruit is limited to 2%.

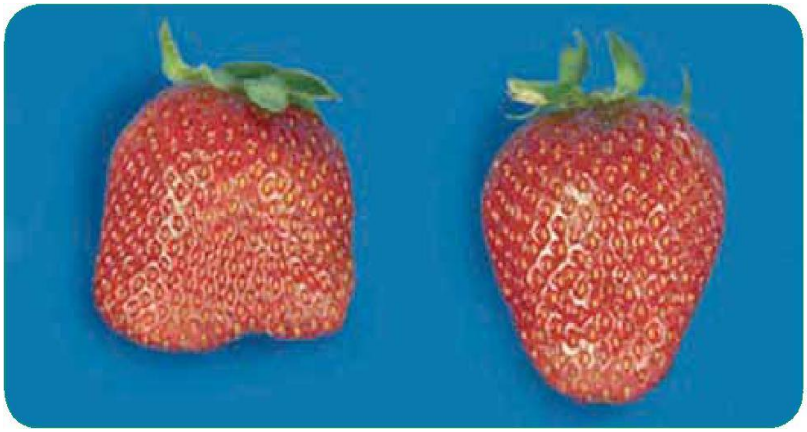

Figure 28: Camarosa strawberry variety. Small shape defects limits allowed for Category I / Typical straight shape

Figure 29: A white area that are not exceeding one one tenth of fruit surface - limits permits for Category I

Figure 30: A white area that are not exceeding one tenth from the surface of the fruit - limits permits for category I

Figure 31: Superficial marks of the pressing - permissible limits for category I

Figure 32: Lack of traces of earth - allowed limits for category I

2.4. Categoria II

Table 4: Quality characteristics and tolerances of category II strawberries

Category II	
Characteristics of strawberries:	**Quality tolerances**
✓ to be of good quality; ✓ this category includes strawberries that not can be included in the higher categories, but corresponding to the minimum characteristics previously defined (figure 33); ✓ strawberries may have the following defects, provided that it retains its essential	- 10% by number or weight of fruit does not meet the requirements of the class or the minimum requirements, with the exception of fruit affected by rotting, severe damage or any other deterioration rendering it unfit for consumption; - within this tolerance, spoiled fruit is limited to 2%.

characteristics as regards the quality, storage and presentation:• - shape defects figure 33; - a white area whose surface not exceeding one-fifth of the surface of the fruit figure 34-35; • - light dry contusions that are not likely to develop figure 36-37; - light dry contusions that will no longer develop 36-37; - slight traces of earth figure 38.	

Figure 33: Camarosa strawberry variety. Small defects shape - permissible limits for category II / Typical straight shape

Figure 34: A white area whose surface must not exceed one-fifth of the surface of the fruit permitted limits for category II / The typical shape

Figure 35: A white area whose area must not exceed one-fifth of the surface of the fruit - permitted limits for category II / The typical shape

Figure 36: Small dry contusions - the limits allowed for category II Typical shape

Figure 37: Small dry cracks - permitted limits for Category II / Typical shape

Figure 38: Slight traces of soil - permitted limits for Category II / Typical shape

The size of the strawberries is determined by the maximum diameter of the equatorial section. Strawberries must have the following minimum sizes:
- Extra Category - 25 mm;
- Categories I and II - 18 mm;
- There is no minimum caliber for wild strawberries.
For all categories: 10% by number or weight does not correspond to the required minimum size.

3. CONCLUSIONS

- The fruits of the baciferous crops are also called fruits with "high value", and their cultivation has gained momentum in recent years and the cultivation of strawberry crops is becoming more and more profitable;
- Strawberries contain vitamins, antioxidants, carbohydrates in larger quantities than the fruits of some fruit species such as apple, hair, plum or cherry, and due to their low structo-textural firmness, delicate tissues, thin skin and high water content, they make part of the category of "soft fruits" or extremely perishable, the duration of consumption being quite short;
- Strawberries can be eaten both fresh and processed and frozen;
- The storage environment of strawberries is influenced by the following factors: light, temperature, relative air humidity, movement and air composition and has a major impact on their quality;
- The quality and lifespan or storage of strawberries depend very much on how they are handled, how they were harvested and the care taken at the time of harvest.

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