



METHOD SENSORY ANALYSIS OF TABLE OLIVES

1. Purpose

This method establishes the necessary criteria for the sensory analysis of the odour, taste and texture of table olives and sets out the methodology for their quality classification.

2. Field of application

The method applies to the fruit of the cultivated olive tree (*Olea europaea* L.) which has been suitably treated or processed and which is offered for trade or for final consumption as table olives according to the trade standard applying to table olives referenced COI/OT/NC No 1 of December 2004.

The method is only applicable for the quality classification of table olives according to the intensity of the defects as determined by a group of 8–10 tasters selected and trained as a panel (ISO 32199:03, Guidelines for the accreditation of virgin olive oil sensory testing laboratories ref. COI/T.28/Doc. No 1).

3. Facilities and equipment

Test room

Refer to standard COI/T.20/Doc. no. 6/Rev. 1 *Guide for the installation of a test room* or ISO 8589.

Equipment

Glasses in conformity with standard COI/T.20/Doc. no. 5 *Glass for oil tasting*, covered with the corresponding watch-glasses.

Plastic or metal cocktail sticks, two-pronged fork, spoon or tongs.

Accessories

The following accessories, which are required by tasters to perform their task properly, shall be supplied in each booth and shall be within easy reach:

- Standard glasses containing the samples, code numbered and covered with a watch-glass;
- Plastic or metal cocktail sticks, two-pronged fork, spoon or tongs;
- Profile sheet (Figure 1 of the method) on hard or soft copy. The line for each attribute must measure exactly 10 cm;
- Pencil or pen;
- Glass of water at ambient temperature.

The panel leader shall be equipped with:

- the software for the statistical analysis of the profile sheet data supplied by the panel tasters according to the method;
- a computer compatible with such software.

4. Specific vocabulary for table olives for the purposes of the method

4.1. Negative attributes

Abnormal

fermentation

Olfactory sensation perceived directly or retronasally, characteristic of abnormal fermentations. Such fermentation may be:

- Putrid: sensation reminiscent of the odour of decomposing organic matter.
- Butyric: sensation reminiscent of butter or cheese.
- *Zapateria*: sensation caused by the combination of volatile fatty acids.

Musty

Olfactory sensation perceived directly or retronasally, characteristic of olives attacked by mould.

Rancid

Olfactory sensation perceived directly or retronasally, characteristic of olives that have undergone a process of rancidity.

Cooking effect	Olfactory sensation perceived directly or retronasally, characteristic of olives that have undergone excessive heating in terms of temperature and/or duration during pasteurisation or sterilisation.
Soapy	Olfactory–gustatory sensation reminiscent of soap.
Metallic	Olfactory–gustatory sensation reminiscent of metals.
Earthy	Olfactory-gustatory sensation reminiscent of soil or dust.

4.2. Gustatory attributes

Salty	Basic taste produced by aqueous solutions of substances such as sodium chloride.
Bitter	Basic taste produced by dilute aqueous solutions of substances such as quinine or caffeine.
Acid	Basic taste produced by dilute aqueous solutions of most acid substances, such as tartaric acid, citric acid.

4.3. Kinaesthetic sensations

Hardness	Mechanical textural attribute relating to the force required to achieve a given deformation or penetration of a product. In the mouth, it is perceived by compressing the product between the teeth (solids) or between the tongue and palate (semi-solids).
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The main adjectives corresponding to different levels of hardness of olives are as follows:

Soft:	low level
Firm:	moderate level
Hard:	high level

Fibrousness	Geometric textural attribute relating to the perception of the shape and the orientation of particles in a product. Fibrousness refers to the elongated conformation of the particles, oriented in the same direction. It is evaluated by perceiving the fibres between the tongue and palate when chewing the olive.
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Crunchiness: Attribute relating to the noise produced by friction or fracture between two surfaces. It refers to the force required to fracture a product with the teeth and is determined by compressing the fruit between the molars.

5. Methodology

Refer to the general ISO standards for sensory analysis, in particular:

- ISO 13300 –1 *Sensory analysis – General guidance for the staff of a sensory evaluation laboratory – Part 1: Staff responsibilities.*
- ISO 13300-2 *Sensory analysis – General guidance for the staff of a sensory evaluation laboratory – Part 2: Recruitment and training of panel leaders.*
- ISO 5555 *Animal and vegetable fats and oils – Sampling.*

5.1. Preparation of the sample of table olives for the test

The sample of table olives intended for sensory analysis shall be representative of a homogenous batch in accordance with the sampling rules. The sample shall weigh not less than 1 kg.

The sample intended for analysis shall be mixed prior to its presentation in the tasting glass.

5.1.1. Sampling rules for the purposes of batch assessment

A distinction shall be drawn between two types of container:

- Large containers (fermenters, 10 000 kg);
- Small containers (carboys, 154 or 308 kg).

(A) Individual organoleptic appraisal

(a) *Large containers*

All the containers shall be sampled.

Take the samples from at least seven different points of the container, including the bottom. The size of the samples shall be 3.5 kg if the olives are small or medium and 5 kg if they are large, of which 1 kg and 1.5 kg respectively shall be sent to the panel for testing.

A sample of brine shall also be taken from each unit for analysis of the chemical characteristics.

(b) Small containers

All the containers shall be sampled.

Take the samples from two or three different points of the container (one from each half or third). The points sampled should be near the surface, near the middle (if applicable), and near the bottom. The size of the samples shall be 1.5 kg if the olives are small or medium and 2.5 kg if they are large, of which 1 kg and 1.5 kg respectively shall be sent to the panel for testing.

A sample of brine shall also be taken from the middle part of each container for analysis of the chemical characteristics.

(B) Appraisal of the overall quality of a batch

(a-1) Preparation of samples from large containers

All the containers shall be sampled.

Take the samples from at least three different points of the container, including the bottom. The size of the samples shall be 1.5 kg if the olives are small or medium and 2.5 kg if they are large. Take a sample of 3 kg from every three fermenters if the olives are small or medium, and of 5kg if the olives are large. Combine five of these samples to form a sample of 15 kg for small and medium olives or of 25 kg for large olives. This shall be the base sample for testing.

A sample of brine shall also be taken from each unit for analysis of the chemical characteristics.

(a-2) Preparation of samples from small containers

Take samples at random from a fraction of all the containers. The following table provides guidelines as to the number of samples to be collected according to the size of the batch.

Batch No. containers	Sample No. containers
< 50	25
51 – 100	25
101 – 200	50
201 – 300	50
301 – 400	70
401 – 500	70
501 – 1000	100
1001 – 1500	150

Take the samples from one or two points of the container; if only one sample is collected, take it from the bottom. The size of the sample taken from each container shall be 0.6 kg for small and medium olives and 1 kg for large olives.

Combine these samples until they form a sample of 15 kg for small or medium olives or of 25 kg for large olives. This shall be the base sample for testing.

A sample of brine shall also be taken from the middle part of each container for analysis of the chemical characteristics.

(b) Calculation of the mean size and batch composition

Determine the mean size by taking three subsamples of 200 g for small and medium olives and 500 g for large olives. More than three determinations shall be carried out if the sizes are very disparate. The size shall be the arithmetic mean of the sizes of the subsamples.

Determine the size dispersion by running the base samples through a suitable grading machine. Calculate the corresponding percentages from the weights of the fractions and record them in the product control reports.

(c) Fruit quality

Reduce the size of the base sample by approximately half to 6 kg for small and medium olives and 12 kg for large olives. Group the olives according to their quality attributes; if any fruit has more than one defect include it in the poorest group.

Record the weights and percentages in the product control report. If the sample does not meet the established maximum and minimum quality limits, the appropriate decisions shall be taken.

The colour of the sample should also be observed during this determination to indicate whether it is in keeping with the variety and whether it is uniform.

(d) Brine analysis

(d-1) Large containers:

The pH, free acidity and Beaumé degrees shall be analysed in all the samples; in addition, the combined acidity and percentage of salt shall be determined in at least 20% of the samples.

(d-2) Small containers:

The pH shall be analysed in all the samples, and the free acidity and Beaumé degrees in 20% of them.

The pH free acidity, combined acidity and percentage of salt shall be analysed in several sets of representative brines (2–5 sets) which shall be formed on the basis of their pH values.

(e) Testing of destoning and lye treatment

This test shall be applied to the most representative sizes used most widely for destoning and stuffing and shall be carried out in the same automatic machines. The sample should be made up of at least 100 fruits although a larger number is recommended.

Broken olives and stone fragments shall be expressed as percentages.

The olives should be checked for lye treatment during this test; if necessary, a representative number of fruit, 20 at least, shall be sliced lengthwise to determine the extent of lye penetration during the initial lye treatment.

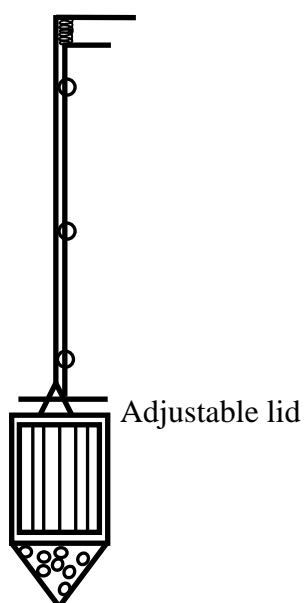
Any internal colouring associated with short lye treatment shall also be reported.

(C) Method of sample collection

The sampler ladle used for taking samples from large containers shall be fitted with a lid which can be opened and shut at the sample collection point to avoid taking samples from other parts of the container, and shall be long enough to reach any point in the container.

A similar utensil or open ladle may be used for smaller containers. Every effort should be made to take the bulk of the sample from the desired point.

Diagram



5.2. Test conditions

5.2.1. *Presentation of the sample*

The sample of table olives for analysis shall be presented in standard tasting glasses complying with standard COI/T.20/Doc. no. 5 *Glass for oil tasting*.

The glass shall contain as many olives as the bottom of the glass can hold when the olives are placed side by side in a single layer. When brined table olives are undergoing analysis, sufficient brine shall be poured over the olives to cover them fully.

When the olives are above the 91/100 size-grade, the volume of sample contained in the glass shall in no case be more than half the height of the glass (i.e. 30 mm.)

In the case of table olives belonging to a size-grade below 91/100, the sample for testing in the glass shall comprise no less than three olives. When brined table olives are undergoing analysis, the quantity of brine in the glass shall come up to at least three-quarters of the height of the olives.

The glass shall be covered with the attendant watch-glass.

Each glass shall be assigned a code made up of random digits or digits and letters, which shall be marked with an indelible, odourless pen.

5.2.2. *Test temperature*

The samples of table olives intended for tasting shall be kept in the glasses at ambient temperature, which may not be lower than 20–22° C.

5.2.3. *Lighting of the tasting booth*

Table olive tasting shall be carried out under white light (daylight), both in the tasting booth and in the test room.

5.3. Procedure

The tasters shall pick up the glass, keeping it covered with the watch-glass, and shall bend it gently to help the sample aromas to be released and blended.

After doing so, they shall remove the watch-glass and smell the sample, taking slow deep breaths to evaluate the direct olfactory sensations cited in the profile sheet (Figure 1). Smelling shall not last more than 20 seconds. If no conclusion has been reached during this time, the tasters shall take a short rest before trying again.

The tasters shall then assess the other sensations cited in the profile sheet. To do so, they shall place one of the olives contained in the glass in their mouth; they shall chew the olive after removing the stone, making sure to spread the chewed olive throughout the whole of the mouth cavity. They shall concentrate on the order of appearance of the *salty*, *bitter* and *acid* stimuli, the retronasal olfactory sensations and the kinaesthetic sensations of hardness and fibrousness and shall assess and note down the intensity of each of these sensations. Next they shall spit out the chewed olives, rinse out their mouth with water and recommence the assessment of the sensations produced by each of the olives contained in the glass.

They shall enter in the profile sheet the overall intensity of each of the sensations perceived when smelling and chewing the olives.

5.4. Tasting sessions

To avoid tasting fatigue and the appearance of bias or contrast effects, each tasting session should entail the sensory analysis of not more than two samples. Between each sample the tasters should rinse out their mouth fully and take a break of at least fifteen minutes.

No more than three tasting sessions should be conducted in any given day. It should be borne in mind that the morning, before lunch, is the period when olfactory-gustatory sharpness is optimal.

6. Classification procedure

6.1. Use of the profile sheet by tasters

The profile sheet for use by the tasters is provided in Figure 1 of this method.

All the tasters on the panel have to follow the procedure set out in section 5.3 of this method. Using the profile sheet provided, they have to record the intensity with which they perceive each of the attributes.

If the tasters perceive any negative attributes not listed on the profile sheet, they shall record them under the 'Other defects' heading, using the term or terms amongst those defined in section 4.2 of the method that most accurately describes them.

Tasters may refrain from placing the olives in their mouth when they observe an extremely intense negative attribute. They shall record this circumstance in the profile sheet.

6.2. Use of the data by the panel leaders

The panel leaders shall collect the profile sheets completed by each of the tasters and shall review the intensities recorded. If they find any anomaly, they shall invite the taster concerned to revise the profile sheet and, if necessary, to repeat the test.

The panel leaders shall apply the method for calculating the median and the confidence intervals according to the method contained in Annex 1. The computer program is presented in Annex 2.

When a defect is entered under the 'Other defects' heading by at least 50 percent of the panel tasters, the panel leaders shall carry out the statistical calculation of this defect and shall arrive at the corresponding classification.

6.3. Method of classifying table olives

Table olives shall be classified in the three following trade categories in accordance with the trade standard applying to table olives, COI/OT/NC No 1:

Extra or Fancy: The high quality olives endowed to the maximum extent with the characteristics specific to the variety and trade preparation are considered as belonging to this category. Nevertheless, providing this does not affect the overall favourable aspect or organoleptic characteristics of each fruit, they may have very slight colour, shape, flesh-firmness or skin defects.

Whole, split, stoned (pitted) and stuffed olives of the best varieties may be classified in this category, providing their size exceeds 351/380.

First, 1st, Choice or Select: This category covers good quality olives with a suitable degree of ripeness and endowed with the characteristics specific to the variety and trade preparation. Providing this does not affect the overall favourable aspect or individual organoleptic characteristics of each fruit, they may have slight colour, shape, skin or flesh-firmness defects.

All the types, preparations and styles of table olives may be classified in this category, except for chopped or broken olives and olive pastes.

Second, 2nd or Standard: This category includes good quality olives which, although they cannot be classified in the two previous categories, comply with the general conditions defined for table olives under section 3.1 of the standard.

Olives that may not be used for human consumption as table olives: This category has been created for sensory analysis purposes. It encompasses olives which cannot be intended for trade because of their significant sensory defects.

Classification according to the defect (negative sensations) predominantly perceived (DPP)

Extra or Fancy: $DPP < 2 \text{ cm}$

First, 1st, Choice or Select: $2 \text{ cm} < DPP \leq 3.5 \text{ cm}$

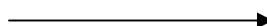
Second, 2nd or Standard: $3.5 \text{ cm} < DPP \leq 6.0 \text{ cm}$

Olives that may not be used for human consumption as table olives: $DPP > 6.0 \text{ cm}$

Figure 1

TABLE OLIVE PROFILE SHEET

INTENSITY



**PERCEPTION OF
NEGATIVE SENSATIONS**

Abnormal fermentation (type) _____

Other defects (specify) _____

**PERCEPTION OF
GUSTATORY SENSATIONS**

Salty _____

Bitter _____

Acid _____

**PERCEPTION OF
KINAESTHETIC SENSATIONS**

Hardness _____

Fibrousness _____

Crunchiness _____

Sample code:

Name of taster:

Date:

Annex 1

METHOD FOR CALCULATING THE MEDIAN AND THE CONFIDENCE INTERVALS

Median

$$Me = [p(X < x_m) \leq 1/2 \wedge p(X \leq x_m) \geq 1/2]$$

The median is defined as the real number X_m characterised by the fact that the probability (p) that the distribution values (X) are below this number (X_m), is less than and equal to 0.5 and that simultaneously the probability (p) that the distribution values (X) are below or equal to X_m is greater than and equal to 0.5. A more practical definition is that the median is the 50th percentile of a distribution of numbers arranged in increasing order. In simpler terms, it is the midpoint of an ordered set of odd numbers, or the mean of two midpoints of an ordered set of even numbers.

Robust standard deviation

In order to arrive at a reliable estimate of the variability around the mean it is necessary to refer to the robust standard deviation as estimated according to Stuart and Kendall (4). The formula gives the asymptotic robust standard deviation, i.e. the robust estimate of the variability of the data considered where N is the number of observations and IQR is the interquartile range which encompasses exactly 50% of the cases of a given probability distribution:

$$s^* = \frac{1.25 \times \text{IQR}}{1.35 \times \sqrt{N}}$$

The interquartile range is calculated by calculating the magnitude of the difference between the 75th and 25th percentile.

$$\text{IQR} = 75\text{th percentile} - 25\text{th percentile}$$

Where the percentile is the value X_{pc} characterised by the fact that the probability (p) that the distribution values are less than X_{pc} is less than and equal to a specific hundredth and that simultaneously the probability (p) that the distribution values are less than or equal to X_{pc} is greater than and equal to that specific hundredth. The hundredth indicates the distribution fractile chosen. In the case of the median it is equal to 50/100.

$$percentile = [p(X < x_{pc}) \leq \frac{n}{100} \wedge p(X \leq x_{pc}) \geq \frac{n}{100}]$$

For practical purposes, the percentile is the distribution value corresponding to a specific area subtended from the distribution or density curve. To give an example, the 25th percentile represents the distribution value corresponding to an area equal to 0.25 or 25/100.

Robust coefficient of variation (%)

The $CV_r\%$ represents a pure number which indicates the percentage variability of the set of numbers analysed. For this reason it is very useful for checking the reliability of the panel assessors.

$$CV_r = \frac{s^*}{Me} 100$$

Confidence intervals of the median at 95%

The confidence intervals at 95% (value of the error of the first kind equal to 0.05 or 5%) represent the interval within which the value of the median could vary if it were possible to repeat an experiment an infinite number of times. In practice, it indicates the interval of variability of the test in the operating conditions adopted starting from the assumption that it is possible to repeat it many times. As with the $CV_r\%$, the interval helps to assess the reliability of the test.

$$C.I._{upper} = Me + (c \times s^*)$$

$$C.I._{lower} = Me - (c \times s^*)$$

where $C = 1.96$ for the confidence interval at the 95% level.

SENSORY ANALYSIS OF TABLE OLIVES

COMPUTER PROGRAM