



## **METHOD SENSORY ANALYSIS OF TABLE OLIVES**

### **1. Purpose**

The purpose of this method is to perform the sensory classification of table olives according to the intensity of any defects as determined by a group of 8–12 tasters who have undergone selection, training and skill building and who make up a panel.

### **2. Field of application**

The method establishes the necessary criteria and procedure for the sensory analysis of the odour, taste and texture of table olives and sets out the systematics for their commercial classification. It is applicable solely to the fruit of the cultivated olive tree (*Olea europaea* L.) which has been suitably treated or processed and which has been prepared for trade or for final consumption as table olives in accordance with the trade standard applying to table olives referenced COI/OT/NC No 1 of December 2004.

### **3. Definitions**

**Sensory analysis:** scientific discipline used to evoke, measure, analyse and interpret reactions to those characteristics of foods and materials as they are perceived by the senses of sight, smell, taste and hearing.

**Taster:** panel member chosen by means of a selection process implemented in accordance with an international standard according to his/her sensitivity and discriminatory power with regard to the organoleptic characteristics of table olives, who becomes skilled after suitable training and whose performance is objectively evaluated on the basis of rules established beforehand by the leader of the panel to which the taster belongs.

**Kinaesthesia:** sensation or sense whereby muscular movement, weight, position etc. is perceived.

**Tasting panel:** group of persons who have been selected, trained and equipped with the necessary skills by means of scientific methods to perform sensory analysis in accordance with international sensory analysis standards.

**Panel leader:** person whose chief duties are to lead panel activities, including taster recruitment, selection, training, skill building and monitoring. He/she designs and leads the sensory tests and analyses and interprets the data and may be assisted by one or more panel technicians.

#### **4. Facilities and equipment**

##### 4.1. Test room

- Tasting booth. Refer to standard COI/T.20/Doc. No 6 *Guide for the installation of a test room* or to ISO 8589:2007 *General guidance for the design of test rooms*.

##### 4.2. Equipment

- Glasses according to standard COI/T.20/Doc. No 5 *Glass for oil tasting*
- Watch-glasses, 8-9 cm in diameter, to cover the tasting glasses.
- Plastic or metal cocktail sticks, two-pronged forks, spoons or tongs.
- Knives.

##### 4.3. 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;
- Pen;
- Glass of water at ambient temperature;
- Spitoons;
- Paper napkins.

The panel leader may optionally be equipped with the following tools:

- Software for performing the necessary statistical calculations in accordance with the formulas supplied in this method;
- Computer compatible with such software.

## 5. Specific vocabulary for table olives for the purposes of the method

### 5.1. 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 reminiscent of rotten leather.

**Musty**

Olfactory-gustatory 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.

**Winey-vinegary**

Olfactory-gustatory sensation reminiscent of wine or vinegar.

5.2. Descriptive 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.

5.3. Kinaesthetic sensations (texture)

Texture is defined as the set of rheological (*related to the flow and deformation of matter*) and structural (*geometrical and surface*) properties of a product perceptible to the mechanical receptors, tactile receptors and in some cases the visual and auditory receptors. The following attributes are assessed in table olives:

**Hardness** Mechanical textural attribute relating to the force required to attain the deformation of a product or for an object to penetrate it (knife, teeth, ...). It is evaluated by compressing the product between the teeth (solids) or between the tongue and palate (semi-solids).

**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.

**Crunchiness:** Attribute relating to the noise produced by friction or fracture between two surfaces. It is related to the force required to fracture a product with the teeth and is determined by compressing the fruit between the molars.

## 6. Selection of tasters

The panel leaders shall select, train and build the skills of the specialised tasters. To do so, they shall develop their own method in which the following aspects must be specified:

- Recruitment methodology used;
- Sensory tests used for selection;
- Candidate acceptance and rejection criteria;
- Methodology used during the training period;
- Criteria used to build taster skills;
- Method for the evaluation of individual and panel performance;
- Performance acceptance and rejection criteria;
- Measures in the event of poor performance.

All proof relating to this important stage in the training of the tasting panel must be kept.

When selecting the tasters it should be ensured insofar as possible that:

- They are representative of the population;
- Both sexes are fairly represented;
- They do not suffer from relevant health disorders, i.e. from ageusia (absence of taste perception) and anosmia (absence of odour perception);
- They are drawn from different professional grades;
- They are interested in tasting.

The panel leader must keep personal dossiers of all the tasters. Besides their particulars (home address, telephone, etc.) these shall include their CV, details of their specific training as table olive tasters and personal records proving their skills. Each personal dossier must also include the express application for voluntary inclusion in the panel and a written commitment to maintain confidentiality regarding information known to and shared with them.

During the selection process it is strongly recommended to determine the recognition thresholds of the olfactory–gustatory attributes of both the panel and the individual tasters in order to ascertain their physiological qualities; this information will be of great assistance to the panel leader. It is recommended to use ascending series of concentrations to determine these thresholds.

Likewise, during the training stage, reference scales of the attributes described in the tasting card should be used for the tasters.

Examples of reference scales are provided below:

Fibrousness:

- Low level: Granny Smith apple
- High level: Central part of pineapple

Hardness:

- Low level: Leerdammer cheese
- High level: Raw carrot

Crunchiness:

- Low level: Peach in syrup
- High level: Celery stalk

Consult the following international standards:

- COI/T.20/Doc. No 14– *Guide for the selection, training and quality control of virgin olive oil tasters –qualifications of tasters, panel leaders and trainers.*
- ISO 8586-1:1993 – *Sensory analysis: General guidance for the selection, training and monitoring of assessors. Part 1: Selected assessors.*
- ISO 8586-2:2008 – *Sensory analysis: General guidance for the selection, training and monitoring of assessors. Part 2: Expert sensory assessors.*
- ISO 13299:2003 – *Sensory analysis: General guidance for establishing a sensory profile.*
- ISO 11036: 1994 – *Sensory analysis: Methodology – Texture profile.*
- COI/T.28/Doc No 1 – *Guidelines for the accomplishment of requirements of standard iso 17025 of sensory testing laboratories with particular reference to virgin olive oil*

## **7. Methodology**

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

- ISO 13300–1:2006: *Sensory analysis – General guidance for the staff of a sensory evaluation laboratory – Part 1: Staff responsibilities.*

- ISO 13300-2:2006: *Sensory analysis – General guidance for the staff of a sensory evaluation laboratory – Part 2: Recruitment and training of panel leaders.*
- ISO 5555:2001: *Animal and vegetable fats and oils – Sampling.*
- EA-4/09 (Rev. 01): *Accreditation for sensory testing laboratories*, July 2003 (European Co-operation for Accreditation).

#### 7.1. Storage of samples

Prior to sensory analysis, the test samples shall be properly stored in conditions that do not cause their alteration. They shall be kept refrigerated at a temperature between 8 and 12 °C and shall be taken out sufficiently in advance to allow them to come to the temperature of the test room when they are to be tasted.

A register of the storage conditions must be kept including details of the measures taken to ensure the anonymity of the samples.

#### 7.2. Preparation of the sample of table olives for the test

The sample of table olives intended for sensory analysis, whether loose or packed, shall be representative of homogenous batches in accordance with the sampling rules. The Codex Alimentarius *General Guidelines on Sampling* (CAC/GL 50-2004) shall be applied for small commercial containers (< 10 kg). See Annex 2. 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.

#### 7.3. Sample preparation and presentation

The samples shall be prepared in the preparatory room by personnel authorised by the panel leader. The tasters may not have access to the preparatory room in order to prevent them from seeing the sample packs or any other details that might suggest aspects that should not be taken into account during the tasting. It should be made clear that access to the room is prohibited for all persons not connected with sample preparation.

The sample of table olives for analysis shall be presented in standard tasting glasses.

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 covering liquid 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 covering liquid 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.

#### 7.4. Test conditions

##### 7.4.1. Glassware

The tasting glasses and watch glasses must be completely clean and free from any odour that might mislead the tasters. For this purpose, they shall be washed with neutral detergents suitable for glassware.

The tasters shall be presented the samples in such a way that it is not possible for them to recognise external characteristics of the samples that might bias their appraisal. To do so, the samples shall be assigned a code comprising digits, letters or both, which shall be marked using odourless markers. Samples shall be coded methodically and records of sample coding shall be kept together with the information on the tasting session.

##### 7.4.2. Test temperature

The samples of table olives intended for tasting shall be kept in the glasses at ambient temperature, between 20 and 25 °C.

##### 7.4.3. 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.



#### 7.5. Procedure

- Tasting session and use of the profile sheet by tasters

When the booths have been prepared by the auxiliary staff, the tasters shall take up their place in silence and check they have everything they need to perform the tasting. If they realise that something is missing, they shall discreetly tell the panel leader or auxiliary staff.

If any of the tasters is not psychologically or physically fit to perform the analysis, he or she must tell the panel leader and refrain from performing the tasting.

It is essential for the panel leader to reiterate the importance of performing the tasting in silence and unhurried.

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 the procedure mentioned below. They shall enter the intensity with which they perceive each of the attributes in the scales of the profile sheet provided.

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 5 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 exceptional circumstance in the profile sheet. They must, however, mark the intensity of the odorous attribute on the corresponding scale.

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, fibrousness and crunchiness and shall assess the intensity of each of these sensations by making the corresponding mark on the intensity scale of the tasting sheet. 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 intensity of each of the sensations perceived when smelling and chewing the olives.

#### 7.6. 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 three samples. Between each session 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 (between 10 a.m. and 12 noon).

### **8. Classification procedure**

#### 8.1. 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 for each of the descriptors. 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, or the technician to whom they delegate this task, shall determine the intensities of the attributes listed in the profile sheet by using a ruler to measure the segment running from the origin of the scale to the mark made by the taster. When this mark lies between two notches on the ruler, they shall assign the value lying closest to one of the notches. The segment shall be expressed to one decimal place. The scale shall measure 10 cm long and the intensity shall range from 1 to 11.

The panel leaders shall apply the method for calculating the median and the confidence intervals according to the method contained in Annex 1 and shall only take into account those attributes with a robust coefficient of variation of 20% or less. The computer program for carrying out the calculations is presented in Annex 3.

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 if the coefficient of variation is 20% or less.

8.2. Classification according to the defect predominantly perceived (DPP)

For classification purposes, the panel leader shall solely take into account the median of the defect perceived with the greatest intensity that complies with the requirements specified in the preceding section. The samples shall then be classified as follows according to the intensity:

**Extra or Fancy:**  $DPP \leq 3$

**First, 1st, Choice or Select:**  $3 < DPP \leq 4.5$

**Second, 2nd or Standard:**  $4.5 < DPP \leq 7.0$

**Olives that may not be sold as table olives:**  $DPP > 7.0$

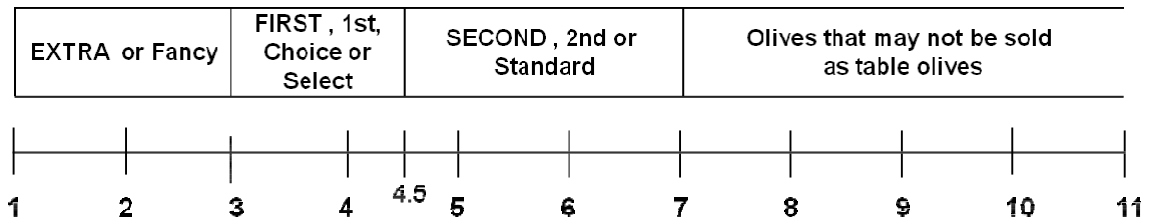


Figure 1

**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:

## METHOD FOR CALCULATING THE MEDIAN AND THE CONFIDENCE INTERVALS

The final result shall state the classification and median of the predominant defect, which shall be given to one decimal place and may be zero, but shall not specify the defect concerned.

In the case of official analyses to check for compliance with the standard, the final result shall be the mean of the medians of two analyses. In the case of counter, appeal or dispute resolution tests, the final result shall be the mean of the medians of three analyses. Duplicate or triplicate analyses must be performed in different sessions and must not differ from each other by more than 2 (2.5) median units. If adequate results are not obtained, further analyses shall be performed until the acceptance criterion is met.

### 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.

## SAMPLING

### Sampling rules for the purposes of batch assessment

A distinction shall be drawn between three types of container:

- Large containers ( $\geq 1\ 000$  kg);
- Small containers ( $\geq 10$  kg < 1 000 kg).
- Packages: < 10 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. 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.

*(c) Packs:* these shall be sampled in accordance with the Codex standard.

#### **(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.



**SENSORY ANALYSIS OF TABLE OLIVES**

**COMPUTER PROGRAM**