GUIDELINES FOR SENSORY ANALYSIS OF PROTECTED DESIGNATION OF ORIGIN FOOD PRODUCTS AND WINES

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PART I

Guidelines

1 Introduction

Food products and wines labelled with Protected Designation of Origin or Protected Geographical Indication (hereafter PDO products) are products with a specific quality and their distinction in the market is a key factor for their success. Producers, who operate in a traditional way, produce PDO products and consumers appreciate their sensory distinctiveness. If producers do not devote enough effort into delivering specific sensory features, it becomes difficult to recognise the appropriate (typical) characteristics PDO products should have; moreover, the products risk becoming similar to other generic products of the same category.

Sensory characteristics are quoted by the EU regulation 1151/12, which deals with PDO products. The producers of PDO products must present the EU authorities a technical specification of their product (including the sensory description) to be sold with this denomination **[1]**. This European regulation also establishes that sensory characteristics included in PDO technical specification must be guaranteed. «Official sensory control» is used to verify the compliance of the product with these defined sensory characteristics **[2].**

In each European country, independent control bodies verify that a product complies with the corresponding product specification. In some countries, government officials carry out this control. The bodies in charge of controlling PDO products should be accredited in accordance with *ISO 17065* **[3].** Accreditation means the demonstration of technical competence and, in the case of the laboratories, it is based on *ISO 17025* **[4]**, which is the current framework used for comparable evaluation of testing activities **[2].**

In the case of PDO products, one of the purposes of the sensory evaluation is to uphold the conformity of the product to the PDO specification through appropriate test methods in the sensory field.

Conformity with the sensory characteristics of the product as established in the PDO specification legally approved implies: a) the identification of specific characteristics of the PDO products, b) the absence of defects (characteristics considered as negative for the PDO) whose noticeable presence makes them unacceptable for the PDO qualification.

Evaluating the sensory compliance of PDO products in relation to the organoleptic description in their official specifications is a difficult task because there are not standard methods for such evaluations **[2]**.

There are currently very different sensory practices in Europe with respect to PDO products and achieving harmonisation will be welcome by all interested parties. These guidelines should be a tool for laboratories or panels working in the field of sensory evaluation of PDO products. This guide presents examples of methodological approaches for the control of PDO products to satisfy technical requirements of the *ISO 17025* and may be used as part of the evaluation of sensory practices by accreditation bodies. These guidelines also include annexes with examples applied to specific kinds of products. These guidelines are an informative document with «useful advice on matters relating to accreditation» according to the *EA – 1/14 M: 2017 Document*: «Procedure for development and approval of EA documents and adoption of ILAC/IAF documents».

The information included in these guidelines is the result of a cooperation, with contributions from many individuals from the European Sensory Science Society (E3S) national organisations, in conjunction with experts from the European Accreditation organisation (EA), and all with experience in sensory analysis methods applied to PDO products. In addition, experts from other stakeholder organisations (consortia, control bodies) have been consulted. EA-4/09 G 2017 Document has been considered as the basic reference *(currently being revised to align with ISO 17025: 2017*) **[5]**.

The purpose of these guidelines is to establish criteria for the development of methodology for sensory analysis of PDO food products.

Vocabulary

For the purpose of these guidelines, we have suggested some terms to be used in conjunction with the official evaluation of PDO products.

Acceptable: «that can be allowed»*. An acceptable PDO product has the minimum acceptable sensory characteristics to be recognised as PDO.

Compliant: «in agreement with a set of rules»*. In this case, the set of rules is the sensory description of a specific PDO product whose characteristics must be found during the sensory control of the product. A compliant product exhibits all the pre-established descriptors for a specific PDO.

Defect: sensory characteristic considered negative for a PDO product. A *Typical defect* is a characteristic which is normally present in the product, but whose intensity is not acceptable for PDO qualification. For instance, during the maturation of a cheese, butyric acid is normally produced, but when the fermentation is excessive there is an increase in butyric acid aroma which is a defect, but it is considered still typical because it originated inside the normal production process. Otherwise, a *Non-typical defect* is something which normally does not appear in a PDO like an unusual fermentation or a taint.

Non-compliant: not in agreement with the sensory characteristics of a specific PDO.

Non-typical or atypical: not showing one or more characteristics expected from a PDO product.

Official evaluation: is the task done by the control body inspecting a specific PDO product in order to assess if the product shows the characteristics indicated in the product description presented in the Geographic Indication register of the European Union.

Scorecard: a physical or digital document on which the sensory evaluation of a product can be recorded.

Sensory modality: sensory characteristics perceived by one sense, e.g., appearance, odour (nose orthonasal), aroma (nose retronasal), taste, texture. Each modality may have parameters, e.g., modality appearance with parameters: colour, shape and surface characteristics.

Typical: «showing all the characteristics that you would usually expect from a particular group of things»**. In this case, the characteristics are those of a specific PDO product as indicated in the product description mentioned above. The sensory characteristics of a PDO product are those appropriate and pre-established as quoted in the product description.

(*) https://www.oxfordlearnersdictionaries.com/. Accessed April 2021

(**) https://dictionary.cambridge.org/dictionary/english/typical. Accessed April 2021

Personnel

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2.1. Sensory panel staff

The staff related to the sensory panel includes the panel leader and where present, the deputy panel leader and the technician(s). The sensory assessors are not usually considered as staff.

The sensory panel leader shall assure impartiality in his/her activity and consequently necessary measures must be taken to achieve this goal (i.e., not allowing commercial, financial or other pressures that compromise his impartiality).

Role, responsibilities and training requirements of the personnel involved in sensory testing should be documented.

Competence, experience and training of the panel leader and technicians should be recorded (*EA 4/09, point 3.1 Sensory laboratory staff* **[5]**), including where relevant:

a) Academic qualifications;
b) External and internal courses attended;
c) Relevant on-the-job training (and re-training as necessary);
d) Previous experience.

Staff and assessor records (consent and assessor's personal data) must be collected and kept up to date in accordance with the national legislation on data protection.

Detailed guidance on competences and responsibilities of the staff in sensory evaluation laboratories can be found in *ISO 13300-1* **[6]**.

2.1.1. Training of the sensory panel staff

Detailed guidance on recruitment and training of the panel leader in sensory evaluation laboratories can be found in *ISO 13300-2* **[7]**

and *EA 4/09* **[5]**. In Italy, the standard *UNI/CT 003/GL 17* defines and qualifies the professional activity of the Sensory Project Manager (*SPM – Sensory Project manager and SPMJ - Sensory Project Manager Junior*). This reference is an example of an officially recognised standard to acknowledge the professionalism of individual sensory panel staff **[8]**.

Staff should possess at least 2 years relevant sensory analysis work experience before being considered as panel leader (*EA 4/09, point 3.2 Panel leader*) **[5]**.

A) Basic training in sensory evaluation (EA/4/09)

Training both of the panel leader and, when present, deputy panel leader and technicians should cover the intended sensory testing area, including at least:

a) Selection of test procedures, experimental design, and analysis;
b) Product preparation and implementation of testing;
c) Data input and processing;
d) Preparation of reports;
e) Maintenance of records;
f) Sensory assessor screening, selection, training, and monitoring procedures;
g) Ethical and health and safety issues related to sensory testing.

B) Specific training for sensory evaluation of PDO product/s

It is essential that the panel leader shall be trained in sensory methodology and be introduced to the specific characteristics of the PDO product. There are four different situations:

1) Training of a panel leader with previous experience in sensory testing

If the aspirant panel leader has at least 2 years of relevant experience in sensory analysis (i.e., leadership in running a descriptive panel, activities in sensory research), he/she can be trained by a professional having knowledge of the sensory methodology and PDO product to be analysed. It is also possible that he/she can be trained by experts of the product indicated by the producers' organisation even if they are not experts in the sensory analysis. In this case, the trainee and experts work as a team so that the parties bring their own expertise in the development of a procedure. The objective is to become able to identify the key attributes and defects of the product

and able to identify the samples which are compliant, acceptable, or not acceptable for PDO qualification. The panel leader should achieve a good level of sensory knowledge and experience with the product in order to be able to train the sensory assessors. This panel leader training should take at least 12 one-hour sessions of sensory testing.

2) Training of a panel leader with experience in the specific PDO product/s

If the panel leader has a demonstrable experience with the specific characteristics of the PDO product/s (i.e., a product expert, technician working with the product) then training will not focus on the product but focus on sensory analysis in the context of becoming a panel leader. This will be achieved by participating in a specific course organised by a recognised society or expert [(i.e., by a European or national sensory society or by a qualified sensory expert (i.e., a nationally/internationally acknowledged expert or a researcher with published papers, etc. with wide experience in sensory analysis)]. The panel leader should acquire the required knowledge and experience about product preparation and implementation of testing, data input and processing, preparation of reports, sensory assessor screening, selection, training, and monitoring procedures. At the end of this training period, he/she can implement the sensory method chosen together with the staff of the PDO producer. The training should as much time as required to reach these goals.

3) Training of a panel leader with previous experience in sensory testing and the specific PDO product/s

This is the obviously the most favourable situation. The training deals only with the development of and gaining experience within the test method chosen together with the staff of PDO.

4) Training of a panel leader with neither previous experience in PDO product nor in sensory analysis

This is the most difficult case, and it is not highly recommended. The training consists of both activities from point 1 and 2 together.

At the end of training (in whichever of the four situations above), the panel leader should have a good knowledge of the method (methodology) chosen for the sensory analysis of the PDO product. The main objectives to be achieved in this period are that he/she shall:

a) Be able to distinguish between typical (sample with all the desired PDO sensory characteristics), acceptable (sample with the

minimum sensory characteristics required to receive the PDO qualification) and non-acceptable (sample without the minimum sensory PDO characteristics) samples;

b) Understand the difference between the concept of hedonic pleasantness and typicity;

c) Understand the difference between typical and non-typical defect (in terms of the product). For example, in cheese, typical defect is a high intensity of butyric acid and non-typical defect could be a cardboard aroma.

To monitor knowledge levels, an evaluation of the panel leader's skills must be performed. For instance, it is possible to present the panel leader 10 samples selected by a commission of experts indicated by the producers' organisation. These samples must include compliant, acceptable, and non-compliant PDO products. The candidate shall identify the correct categories of these products giving some comments about the perceivable descriptors.

Once the panel leader has completed the training and passed the skills evaluation, he/she can in turn instruct the panel technician(s) and eventually the deputy panel leader, informing them about the specificity of PDO sensory testing and ensuring they gain the necessary experience with the sensory method chosen.

The panel leader shall be able to write periodical reports about the performance of the panel suggesting, if necessary, measures to improve the quality of the results.

Progress and outcomes of the panel leader, deputy panel leader and panel technician(s) training programme shall be recorded.

2.2. Sensory assessors

Generally recommended procedures for recruitment, selection, training and monitoring of sensory assessors can be found in *EA 4/09, point 3.3 Sensory assessors* **[5]**. Such activities should be documented. Detailed guidance on the recruitment, selection, training and monitoring of candidates intended to become sensory assessors can be found in *ISO 8586* **[9].**

The panel leader has the responsibility for the management of the sensory assessors and supervising:

- Recruitment;
- Training;
- Monitoring;
- Warming up;

- Re-training;
- Possible expulsion of assessors.

A preliminary requirement is that the sensory assessors participate voluntarily via informed consent. The panel leader shall ensure their safety and the confidentiality of their personal information.

Recruitment, training procedures, and control requirements for the monitoring of assessors should be adequately documented. Training, re-training, and monitoring results should also be recorded.

2.2.1. Recruitment

The assessor shall be able to detect, recognise, and describe the most relevant sensory characteristics related to appearance, odour, taste and texture. He/she shall be able to describe product characteristics. The assessor shall show interest in the PDO product and in sensory evaluation and shall have good attitude towards teamworking.

Like the panel leader, if the assessor is familiar with the product, the training will be less time consuming. The ideal area of recruitment is the PDO product production area. There are three types of assessors with appropriate experience: technicians working with the PDO, experts indicated by the producer's organisation, and expert consumers of the product (i.e., dealers, restaurateurs, members of tasting associations…).

A panel setup of assessors with relevant experience in sensory analysis, and no previous experience with the product has no need of basic training. However, the training for sensory evaluation of the PDO product will require more time to allow the panellists to gather adequate experience in evaluating the compliance of the product with respect to the sensory specification of the PDO product.

2.2.2. Training

The training protocols and procedure must be adequately documented in a specific operating procedure.

A) Basic training

Selection and training tests should be based on recognised reference documents (*ISO 8586* **[9]**, International Organisation of Vine and Wine - OIV, International Olive Oil Council - IOC, International dairy Federation - IDF...).

During selection, recognition and perception of typical odours and the basic tastes should be confirmed. Detailed guidance on initiation and training of assessors in the detection and recognition of odours can be found in *ISO 5496* **[10]** and guidelines for investigating sensitivity of taste can be found in *ISO 3972* **[11]**.

The specific procedure could include:

- Tests for detection and recognition of a stimulus (detection threshold and recognition threshold); discrimination of the intensity of stimuli; description of visual, olfactive, taste, and texture stimuli;
- Training with matching, discriminant, or ranking tests for smell, taste, and texture characteristics;
- Training using intensity scales, descriptive tests, and descriptive-quantitative tests.

B) Training with products of the same food category of PDO (i.e., wines, oils, meats, cheeses, etc.)

There should be at least four training sessions relating to the general PDO category.

The specific procedure should include:

- Two descriptive tests according to the method chosen for the PDO product, in order to familiarise with the sensory procedure;
- Two descriptive tests with the product in order to familiarise with the sensory methodology employed in the evaluation of the PDO.

C) Specific training for the PDO product

There should be at least six training sessions relating to the PDO product specifically.

The specific procedure could include:

- Presentation of the specific characteristics of the PDO products by an expert or the panel leader;
- Descriptive test with the PDO products according to the chosen method;
- Training with products on defects (difference between appropriate and non-appropriate defects); this is products with «typical» and «non-typical» descriptors, including defects;
- Training with products to understand the difference between typicity and liking, this topic has to be carefully managed because misunderstanding can lead to inconsistencies in results.

2.2.3. Qualification

The assessors shall be able to discriminate between compliant (product in total conformity with the sensory description of the PDO), acceptable (product with the minimum characteristics to be certified as PDO), and non-compliant product category. The panellists' results over duplicate samples shall be repeatable.

A final test to confirm the effectiveness of the training should be carried out (for example, with at least four samples, in duplicate, of which at least one is non-compliant with the PDO product).

2.2.4. Monitoring

The experience gathered by PDO panels already active, shows that an effective control of the performance of the assessors and the panel as a whole in each session should be carried out and, if enough sessions are run, an effective periodic cumulative control measure should be also defined (for example, every five sessions). If the number of sessions and samples evaluated are low, the quality of the results of the sensory panel must be monitored at least once a year. The panel leader should establish acceptability limits for performance for the single assessors and the panel as a whole.

Adequate performance of the individual assessors (and the sensory panel, as a whole) requires their participation in a sufficient number of evaluation sessions per year. Sensory assessors should participate in sessions at least once a month to reach a minimum of twelve a year. On the other hand, overuse of assessors can negatively affect their performance.

Each individual panellist shall be checked for repeatability, ability to discriminate samples, and bias compared to the panel average.

2.2.5. Warming up after a pause for a defined period of time

If the panel has performed no tests for a «short» period (i.e., one and a half months), then a warmup tasting session is highly recommended. If the period is longer (i.e., three months) then, at least two sessions could be necessary. If the period is even longer, then it is up to the panel leader's discretion to decide which re-training is necessary.

2.2.6. Re-training and expulsion

If the results of one of the assessors fall outside the acceptable limit of performance, the panel leader decides the type of re-training ac-

cording to the problem detected. In each case, at least two re-training sessions are necessary and adequate results should be provided by assessor.

If an assessor repeatedly does not follow the directions of the panel leader, he/she can be removed from the panel. The same if he/she fails to produce reliable results in the panel after two retraining courses with respect to the same problem.

Environment and equipment

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Environmental conditions are particularly important, and the organisation should provide appropriate requirements and controls necessary for carrying out sensory evaluation. The design of test rooms for sensory analysis is covered in *ISO 8589* **[12]**.

In the case of PDO products, requirements are the same as those for sensory evaluation in general. Specifically, testing must be performed in a specific area dedicated for the purpose. The organisation should provide a suitable area for the test:

- Quiet, free from distractions, and with controlled lighting, temperature and humidity;
- Partitions between subjects to minimise visual contact;
- Neutral colours for the walls and furniture;
- Odour-free surfaces and appropriate ventilation.

In addition, there should be a separate area for sample preparation, and also equipment and measuring instruments to demonstrate effective control of the environmental conditions (for instance temperature-controlled areas, preparation and storage of samples, sample-serving facilities). Records that demonstrate the fulfilment of this requirement should be maintained.

Test methods

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4.1. Approaches

Methods applied in Europe for the official sensory control of PDO products can be classified into two groups: generic methods for categories of food products (e.g., olive oil, wine, cheese) and specific methods for food products within a category (for example a specific PDO cheese) **[2]**. Moreover, there are methods that do not describe the products, but only identify defects (or focus on identifying defects). Given the current regulation in Europe, this approach is unsatisfactory for the sensory control of PDO.

Two main approaches are used in the sensory control of PDO products: identification of perceived attributes (citation frequencies of «typical attributes» and «defects») or quantification of the intensity of attributes using continuous or discontinuous rating scales from three to ten points. Some of the methods applied for the sensory control of PDO products considers the description of the product and the compliance scores on separated or integrated scales **[2]**. *See examples of different test methods approaches in Annexes A and B of these guidelines*.

The perfect solution does not exist, and different methods may be acceptable at European level. Obviously, although sensory control methods should be adapted to the specific sensory characteristics of the product, it is possible to establish common good sensory analysis practices applicable to all of them.

4.2. General description of the test methods

Many sensory methods have been introduced to be applied in food quality control. *ISO 20613* **[13]** gives a brief overview of four of these

methods, which are the most common ones: «in-out test», «difference from control», «difference scoring with key attribute scales» and «descriptive analysis».

Methods applied to sensory quality control of PDO products could embrace different approaches. All methods must include objective sensory measures and specifically trained sensory assessors must apply them. It is desirable to use standard methods or failing that, methods published in recognised scientific journals. Unfortunately, there are only a small number of scientific contributions relating to methods applied to PDO products. Therefore, in general, it will be necessary to develop specific in-house methods. *Annex B* of these guidelines shows examples of published methodological approaches and test methods currently applied to PDO products.

Any method applied to the control of a PDO should consider key (typical) sensory attributes normally perceived in the product and other less frequently perceived sensory attributes, but also non-typical attributes and defects. Normally, the experts and the producers of the PDO products have the knowledge of the product and decide which sensory attributes are typical or not in the product. However, the development of suitable methods requires the participation of professionals with knowledge of sensory analysis. With the possible evolution of the characteristics of the PDO product over time, methods should be kept up to date. *Annex A* of these guidelines gives guidance for the introduction of sensory analysis in PDO official control.

Methods for the sensory control of PDO products must include the following aspects as a minimum:

a) Sensory definitions and appropriate evaluation procedure of the selected sensory attributes, including defects;
b) Order of evaluation of the sensory attributes according to the order of perception;
c) Procedures (available in each booth for the assessors during the sensory evaluation) to evaluate samples in the same way (order of evaluation, procedure of evaluation, tasting technique, instruction for spitting or swallowing samples, etc.);
d) Consistent preparation and serving temperature of the samples;
e) Order of presentation of the samples to the sensory assessors, minimising physiological (e.g., adaptation) and psychological biases (for example, in liquid products, such as wine or oil, the influence of the observation of the appearance during the olfactory and flavour evaluation, contrast/ convergence, or carry over effects);
f) In accordance with the characteristics of the product, the following should be defined: sample schedule per session (a session could be composed by one or more series of samples), waiting time

among series of samples, and maximum number of samples per session (assuming a session per day). For example, maximum six wine samples per series and two series per session; or four olive oils in each series with a maximum of three series per session;

g) Number of assessors participating in the sessions. Minimum number required in sensory evaluations is five trained assessors; however, the minimum number recommended is eight;
h) Particular environmental conditions and materials (lighting, glasses, heaters, products for the elimination of taste and flavour between samples...) if necessary;
i) Statistical treatment, expression of the results and other information to be included in the sensory analysis report;
j) Relationship between the results of sensory analysis and the attribution of compliance to PDO regulation.

In addition, for each PDO product, the organisation must have documented the following information:

- Qualitative sensory reference materials to harmonise assessors with respect to the concept of the sensory attributes included in the evaluation scorecard, and quantitative sensory references for training assessors in the use of scales, when applicable (*see section five of this guide*);
- Assessor training procedures (recruitment, basic and specific training for applying the sensory control method of the PDO product) (*see section two of this guide*);
- Qualification requirements and qualification test procedure (*see section two of this guide*);
- Procedure for monitoring the performance of assessors individually and of the panel as a whole, including the requirements (control limits) for repeatability/reproducibility, panel agreement and discriminative capacity (*see section seven of this guide*). A reference for monitoring the performance of a quantitative sensory panel is standard *ISO 11132* **[14]**;
- Re-training and re-qualification procedures for the assessors in the case of performance out of the control limits or after a long period of inactivity in product sensory testing (*see section two of this guide*).

4.3. Specific requirements of test methods

Other specific technical criteria should be considered in the definition of the test methods:

Identification of attributes (citation frequencies)

When reporting the number of assessors who have identified a descriptor (citation frequencies or percentage) one should be aware that the percentage of assessors who identify an attribute is not a measure of the intensity of the attribute. In these type of methods is difficult to apply statistical criteria to develop specifications of compliance because a larger amount of data is necessary. It can be considered that a descriptor is present if the majority of the assessors identified it.

Quantification of the intensity of attributes

Quantification of the intensity of typical attributes and defects must be done by using some type of scale. Either the mean or the median of the intensity scores of the panel can be used.

Sensory evaluation scorecard

The panel must use a standard evaluation scorecard. The sensory evaluation scorecard cannot include the following:

- Definitions or descriptions of the points on the scales that could induce the assessors to evaluate subjectively;
- Hedonic terms;
- Scoring calculation by the assessors during the sensory evaluation. The application of a scoring calculations system based on the result of the sensory evaluation must be carried out after the session (data treatment) and is not part of the evaluation by the assessors.

As stated in the *section 4.1 Approaches*, regarding the methods currently applied to PDO sensory control we can distinguish between defect-free assurance methods and methods that go beyond defect identification and include a sensory description of the product.

In the defect-free assurance methods, the compliance of the sample is deriving from the absence or low presence of defects.

In methods that go beyond the identification of defects, two main approaches are applied according to the nature of the scores obtained on the scorecard:

- *Intensity of attributes,* where previously defined specific ranges (limits of intensity) are used to determine if the PDO product is acceptable or non-acceptable (see examples in *Annex A and B*);
- *Compliance score*, where score indicates if the typical established characteristics are present or not based on the sensory evaluation.

This score demonstrates how much the product presents the established typical characteristics or if it deviates from these characteristics. In this approach there are some options (*see examples in Annex A and B*). A single general compliance score without information about appropriate descriptors and/or defects is non-acceptable because it does not explain the reason for the compliance score.

Assessor variability estimation

There must be a calculation of the variability of the assessors' scores for each sample and attribute, and a criterion that allows a decision of whether that variability is acceptable or the sample has to be re-evaluated by the panel.

Data deletion

Although not recommended, if data are deleted from sensory sessions on a regular basis in order to meet the criteria of maximum acceptable dispersion among assessors, a minimum number of data points (at least five valid results of assessors) must be retained for the data to be useable.

4.4. Sensory analysis report and interpretation in relation with the official regulation

The sensory analysis report is authorised by the panel leader and must properly describe (in term of citation frequency or intensity) the results of all attributes and defects of the PDO product as assessed by the panel.

The information relating to the tasting must appear on the sensory analysis report, noting in particular the description of the sample, the evaluation protocol and the statement of conformity when it is requested.

The statement of conformity of the reported results can be completed by the panel leader and consists of evaluating the results of the sensory analysis against the specifications or organoleptic requirements of the PDO product.

To correctly carry out this activity, there must be documented evaluation criteria that is used to declare conformity or non-conformity with the aforementioned requirements. The declaration of conformity, the appropriate identification of the PDO specifications and the document containing the evaluation criteria, must be included in the

test report (for example, indicating its revision status and /or date of approval). The document containing the evaluation criteria should be approved by the PDO «Control body» or published by the competent authority.

The control body, who is responsible for official control carried out to verify compliance with the PDO specification, inspects the sensory report to verify the compliance of the sampled product with respect to the PDO product specifications.

4.5. Validation

At the end of the method development, tests should be carried out that demonstrate the suitability of the method for the intended purpose, employing the minimum established number of qualified assessors.

These tests should consider the performance of the panel (repeatability, reproducibility, agreement of assessors, discriminant capacity).

The validation report must describe at least the following aspects:

a) Experimental design (number of samples, assessors, sessions, sample replications).
b) Expected results deriving from the samples selected. The samples used should be both products considered appropriate and non-appropriate products; this is products with typical and non-typical descriptors, including defects.
c) Statistical analysis methods applied.
d) Requirements for repeatability/reproducibility (the panel results shall be repeatable), agreement of assessors and discriminative capacity (the panel shall be able to discriminate between compliant, acceptable, and non-compliant products).
e) Records of results and analysis to demonstrate the effectiveness of the method for the intended purpose.

4.6. Records

Records should be maintained to include information needed to standardise the test activities, information and parameters related to preparation, realisation and data collection of sensory tests, and records of the results of the sensory tests carried out by the panel for each session.

Reference materials

5

For each sensory descriptor, including defects, when possible, an appropriate standard reference should be available to ensure a harmonisation of the sensory concepts among assessors and to facilitate their training.

Reference materials should be used in training sensory assessors, monitoring panel performance and validating methods.

For many types of analysis, training may be carried out using standards prepared within the laboratory from food grade chemicals of known purity and composition; in other instances, it may be necessary to use representative foods or other materials.

The identity and concentration of each chemical compounds and details of all ingredients and commercial products involved in reference preparation must be documented. The panel leader must establish a system for make-up and use of these references, thus ensuring that they are always made and applied in the same way.

Particularly important for PDO products is to establish reference samples for typical and non-typical characteristics and reference samples for specific defects of the specific PDO product.

Sampling, samples handling and preparation

6

The sensory staff are not normally responsible for collecting the sensory samples.

A written procedure for sample acceptance, storage, and identification should be available. In addition, there should be a documented formal procedure with detailed information for guaranteeing consistency of sample preparation and presentation to the assessors, always considering their safety.

Samples should be stored so that their integrity is preserved. Storage areas should be kept clean and organised. Extremes of environmental storage conditions, which might change the sensory attributes of the samples, should be avoided.

Quality control

7

Quality control (performance monitoring) can be carried out in different ways, but it should always be defined and must be effective to ensure that the reliability of the panel and method is maintained.

For example:

a) Replicate analysis of samples can be performed as a defined percentage of the total samples analysed. As far as possible, these repeated samples should cover the diversity of PDO product quality. As a guide, the level of quality control could be about 5% of the samples tested, although a greater percentage may be required for procedures that are more complex (*EA 4/09, point 12.1 Internal quality control* **[5]**).

b) Reference samples (including samples with different sensory descriptions, samples with typical and non-typical characteristics, samples with specific typical and non-typical defects) can be introduced into the sample analysis system at appropriate intervals. These samples could be prepared by the panel leader with the help of product experts.

c) Reference and characterised materials different from the product samples can be used as a part of a quality control system (e.g., images for evaluation of colour…).

When possible it is advisable for the panel to participate in proficiency testing (inter-laboratory or intra-laboratory tests of the same product) which are relevant for evaluating the performance of both assessors individually and of the panel as a whole **[15].**

Ethical issues

Sensory activities should be carried out considering ethical aspects of using human subjects; mainly safety, voluntary participation, and confidentiality of personal information. Sensory practices should be conformed to health and safety regulations. Assessors should always give their informed consent to participate regularly in sensory testing. Personal data should be treated and managed according to the European regulation (EU) 2016/679 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data **[16]**.

References

[1] **OJEU (2012).** Regulation (EU) No 1151/2012 of the European Parliament and of the Council of 21 November 2012 on quality schemes for agricultural products and foodstuffs. Official Journal of the European Union, 14.12.2012, L 343/1-29.

[2] **Pérez-Elortondo, F.J. *et al.* (2018).** Current status and perspectives of the official sensory control methods in Protected Designation of Origin food products and wines. *Food Control*, 88, 159-168.

[3] **ISO (2012).** Standard 17065: Conformity assessment - Requirements for bodies certifying products, processes and services. Geneva: International Organization for Standardization.

[4] **ISO (2017).** Standard 17025: General requirements for the competence of testing and calibration laboratories. Geneva: International Organization for Standardization.

[5] **EA (2017).** EA-4/09. Accreditation for sensory testing laboratories. Rev02. https://european-accreditation.org/wp-content/uploads/2018/10/ea-4-09-g-rev02-february-2017.pdf (Accessed: April 2021).

[6] **ISO (2006).** Standard 13300-1. General guidance for the staff of a sensory evaluation laboratory. Part 1: Staff responsibilities. Geneva: International Organization for Standardization.

[7] **ISO (2006).** Standard ISO 13300-2. General guidance for the staff of a sensory evaluation laboratory. Part 2: Recruitment and training of panel leaders. Geneva: International Organization for Standardization.

[8] **UNI (2016).** UNI 11637 Attività professionali non regolamentate - Responsabile Progetti Sensoriali - Requisiti di conoscenza, abilità e competenza. Ente Italiano di Normazione.

[9] **ISO (2012).** Standard ISO 8586. General guidelines for the selection, training and monitoring of selected assessors and expert sensory assessors. Geneva: International Organization for Standardization.

[10] **ISO (2006).** Standard ISO 5496. Initiation and training of assessors in the detection and recognition of odours. Geneva: International Organization for Standardization.

[11] **ISO (2011/Corr.1: 2012)**. Standard ISO 3972. Method of investigating sensitivity of taste. Geneva: International Organization for Standardization.

[12] **ISO (2007).** Standard 8589. General guidance for the design of test rooms. Geneva: International Organization for Standardization.

[13] **ISO (2019).** Standard 20613: General guidance for the application of sensory analysis in quality control. Geneva: International Organization for Standardization.

[14] **ISO (2012).** Standard 11132: Guidelines for monitoring the performance of a quantitative sensory panel. Geneva: International Organization for Standardization.

[15] **Garavaldi *et al*. 2015**, Results of Sensory Analysis Proficiency testing of Parmigiano Reggiano Cheese. *Scienza e Tecnica Lattiero Casearia*, 66 (2015), 117-123.

[16] **European Commission.** Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation) https://eur-lex.europa.eu/eli/reg/2016/679 (Accessed: April 2021).

PART II

Annexes

Annex A

Guidance for the introduction of sensory analysis in PDO official control

A.1. Introduction

Sensory analysis is a useful tool for PDO products because it allows the sensory characterisation of protected food products, the determination of the effect of some factors (linked to raw materials, environmental conditions and technological aspects of production process) on the sensory characteristics of the products or the study of the sensory perception of consumers regarding these protected food products.

The official sensory control of PDO products is a legal requirement that demands for the development of sensory tests aimed at determining the degree of compliance with the sensory characteristics included in the technical specification of the European regulation of these protected products. This official control is similar to the quality control carried out by the food industry to evaluate the compliance with a previously defined sensory standard. However, in general, PDO products are made in a more traditional way compared with other generic products of the same category, and in some cases, are associated with specific sensory characteristics linked to the territory, raw materials and/or the manufacturing process. Frequently, these products tend to have less sensory homogeneity between units, lots or seasons. This sensory variability, unlike most processed foods, could be considered, to some extent, a sensory and gastronomic benefit rather than a problem to be avoided.

The area of application of quality control of sensory analysis has been little discussed in the scientific literature **[1, 2, 3, 4]**. Recently published, *ISO 20613* **[5]** briefly describes four methods, commonly applied in control programs in the food industry:

- «*In-out test*», which is a popular procedure at the production level that allows determination of whether the sample conforms to the specification or not (differentiating normal production from different or out-of-specification products).
- «*Difference from control test*», which indicates the magnitude of the overall difference of the sample from a standard or control sample using a single scale. As the «in-out test», this approach is suited to products with few sensory characteristics that vary in production.
- «*Descriptive analysis methods*», which provides intensity scores of key attributes perceived in the product. A more detailed reference for the development of descriptive sensory analysis is *ISO 13299* **[6]**.
- «*Difference scoring with key attribute scales*», which is a combination of the two previous methods since it allows to determine not only the magnitude of the global difference with respect to the control, but also the direction and magnitude of the differences in key descriptors.

The content of the *ISO 20613* is useful for application to PDO products with well-established control parameters (specifications, tolerances...), as well as known/agreed references. However, while in the food industry the quality standard is determined mainly by what the consumer perceives to be a quality product, given the particularity of the PDO products, the sensory control test definition requires the participation of experts on the product, especially for establishing sensory standards.

The aim of this Annex is to provide guidance for the development of a programme for the introduction of sensory analysis in official PDO control.

A.2. Methods applied to PDO official control

Methods currently applied to PDO sensory control can be divided roughly into two groups (**Table 1**): methods to ensure that products are defect-free and methods that go beyond defect identification and include a sensory description of the product.

Table 1. Control methods currently applied to PDO sensory control (adapted from **[8]**).

Methods				
Don't describe products (only defects)	Do describe products (defects and positive attributes)			
	Only identification (citation frequencies)	Quantification (intensity 3-10 point scales)	Identification or quantification and scores of compliance (degree of conformity or trueness to type scales)	
			Scores of compliance in separated scales	Scores of compliance in integrated scales
	Difficult to apply statistical criteria to develop specifications of compliance due to the low number of data points (5-12 assessors)	Less difficult to apply statistical criteria to develop specifications of compliance	Extensive training and experience required to understand attributes and how these can vary within established specification	Previous defined specification and description of conforming product is required
	(wine)	*(oil, wine, Asiago)*	*(Parmigiano-Reggiano)*	*(Idiazabal, Rioja Alavesa, Txakoli, Traditional Balsamic Vinegar)*

A.2.1. Methods to ensure the absence of defects

In methods to ensure the absence of defects, sensory evaluation is based on the identification of defects either by the assessors citing defects present (see PDO wine in Italy **[7]**), or attributing a score to each defect descriptor (see example TGS Serrano Ham in **[8]**). The compliance of the sample is thus deriving from the absence or low presence of defects. Methods that only identify defects, but do not describe the products, are unsatisfactory for the sensory control of PDO products and are not considered in this guide because the PDO regulation requires an organoleptic description of the products.

A.2.2. Methods with sensory description

In methods with sensory description that go beyond the identification of defects, two main approaches are applied (see examples in specific classes of products in *Annex B*): *intensity of attributes* and *compliance score (degree of conformity or trueness to type)*. Although both approaches provide a qualitative and/or quantitative description of sensory attributes and possible defects in the products, they differ in the nature of the scores obtained on the scales of the sensory evaluation scorecard.

A.2.2.1. Intensity of attributes

This is the application of conventional quantitative descriptive sensory analysis for the development of sensory profiles, which provides intensity scores of attributes characteristic of the product and of defects. An example of this type of approach is the methodology proposed by the International Olive Oil Council (IOC) for the categorisation of the quality of olive oil **[9]** and for extra virgin olive oils that opt for a PDO **[10]**. Another possibility is to have a target range of intensity for each descriptor, which is considered acceptable for the product. If the intensity score falls outside these limits (too low or too high intensity), the product is considered not acceptable for the PDO. For example, this method is used for the Asiago cheese **[8]** and Asparagus from Navarra IGP **[11, 12]**.

A.2.2.2. Compliance score (degree of conformity or trueness to type)

The aim of this approach is to evaluate the adequacy of the product to pre-established sensory standard categories. Such categories for PDO products are based on the presence of typical attributes and defects or atypical attributes (see terms definitions *in the introduction*

section of these Guidelines). Examples of these approaches are the methods proposed by International Dairy Federation (IDF) and ISO for cheese **[13, 14]**, the method applied to sensory quality control of Trentingrana cheese **[15]** or the methods developed in LASEHU on cheese **[16, 17]** or wine **[18, 19]**. Including in this group, is also the method used for the evaluation of the vinegar Aceto Balsamico Tradizionale di Reggio Emilia **[20]** and that used for the Parmigiano-Reggiano cheese **[8, 21]**. See explanations of these methods in *Annex B.* These methods allow «going beyond PDO certification» since between the minimum score to allow certification and maximum score (optimal product), it is possible to establish scoring ranges that classify the products in different categories of suitability/ conformity.

It is possible to apply different sensory methods for the official control of PDO products. However, any methodology used should at least:

- Identify the degree of specificity required for each typology of product within the PDO. For instance, the Oliva Ascolana del Piceno can be produced either as olives in brine or stuffed olives and consequently it has different sensory descriptions and evaluation methods;
- Apply best practices for sensory analysis (ISO standards, publications from international food and beverages organisations, scientific publications);
- Establish the attributes (necessary to define the typicity of the product) to be evaluated and ensure that all the sensory assessors, using sensory references, understand uniformly the sensory concepts in relation to these attributes;
- Define detailed sensory evaluation techniques and ensure that all assessors apply them;
- Objectify and standardise the sensory evaluation procedure;
- Define an appropriate statistical treatment of data;
- Establish criteria and limits to determine the degree of the compliance in relation to the sensory description of the product included in the official technical specification of the PDO product.

A.3. How to introduce sensory analysis in PDO official control

A.3.1. Material and human resources needed for sensory analysis

Food companies recognise the importance of sensory analysis because the intrinsic quality of their products is considered as a strate-

gic resource. In general, in larger companies, sensory analysis is undoubtedly an important element in product development and quality control programs. Small businesses, even though they know how useful the practice of sensory evaluation might be, often find it difficult to cover the costs of these activities. The development of new methods (faster and more flexible) can solve this problem to a certain extent.

Similarly, public institutions and PDO producers are concerned with the improvement and control of PDO products in their territory. Obtaining useful information based on reliable sensory results requires both PDO producers and institutions to consider sensory analysis as a technical activity that requires material and human resources. PDO producers have different sizes and each of them must decide if they have the economic and technical capacity (knowledge, facilities, reference materials…) to adequately carry out this technical activity or need to outsource to public or private laboratories. In terms of sensory analysis, a main challenge for PDO producers currently is the development of specific sensory methodologies to carry out the official sensory control in a technically appropriate way.

A.3.2. Establishing sensory standards and defining the sensory method

The development of sensory control methods for PDO products is an ongoing process. Scientific publications providing approaches for developing sensory standards for PDO control are scarce. Commentators agree that sensory typicity of any PDO product should be defined by both experts involved with the PDO product and by sensory analysis professionals **[16]**, and based on a consensus with the producing sector **[22]**. In the case of some PDO products, it can be difficult to establish what are typical sensory characteristics and it may be doubtful whether the product has sensory characteristics that differentiate it from similar products.

As a rule, any standard for the sensory control of a PDO product should consider typical sensory attributes frequently perceived in the product, but also atypical attributes and those considered defects (see terms definitions *in the introduction section of these Guidelines*). Furthermore, the standards must be consistent with the presence of sensory attributes unambiguously perceived in the product, as well as with their possible changes over time. These sensory characteristics are what must be included in the PDO product specification.

The main aspects to consider in defining the sensory standards for PDO products are as follows:

a. Creation of the working group

The working group should be a group of maximum ten to twelve persons, mostly product experts (technicians and connoisseurs of the product, i.e. producers or users), but should also include sensory analysis professionals. In many cases, it is not easy to find individuals with the correct profile, that is, experts in the PDO product and its sensory characteristics, with a wide knowledge of the different types of products within the PDO. These experts must be able to describe the sensory characteristics that differentiate the PDO products from other similar non-PDO products or from other PDO products. The education and experience of these experts may differ. For example, in the case of wine, we can find this profile among oenologists, winemakers or sommeliers. For example, the participation of different types of experts is expressly stated in French regulations **[23]** when product representativeness is considered.

b. Sessions of the working group

The number of sessions depends on the diversity and specificity of the products to be defined within the PDO. Six can be considered the minimum number of sessions required. For the evaluation of simple products, the number of sessions could be lower. A preliminary focus group session is recommended to understand the participants' points of view in relation to the product and to explain the objectives and process to the group. The duration of the discussion session could be around 2 hours. It is advisable to leave some time (at least two weeks) between working sessions to analyse the results of the previous session and ensure the effectiveness and efficiency of the next session. It is also useful to move forward with the study of ideas and proposals via background and desk research.

During face-to-face sessions, a sensory analysis professional who is member of the working group moderates the working sessions where both theoretical and practical discussions are carried out based on the sensory evaluation of representative product samples and reference materials.

c. Samples

Samples (between 2 to 10, depending on the content and the objectives of each session) from different producers should be evaluated throughout the discussion sessions, covering the range

from defective products to ideal typical products. Products selected for each session should be coded with three-digit codes and served under appropriate conditions for evaluation (e.g. temperature, light source, portion size,...). All participants should, as far as possible, be served the same samples with the same appearance, same temperature, and receive the same quantities or volumes of samples. In order to avoid possible colour bias, specialised equipment (for example, black glasses in the case of wine) may be required. In addition, waiting time between samples and palate cleansing materials (water, unsalted crackers, apple…) to eliminate residual sensations between samples should be considered.

d. Establishing of sensory standards and defining the sensory method

As indicated in section A.2.2, among methods with sensory description that go beyond the identification of defects, there are two modes to evaluate the adequacy of the product to predefined characteristics as indicated by the PDO regulation: *Intensity of attributes* and *Direct compliance score* (degree of conformity or trueness to type):

- ***Intensity of attributes***

  Standardised methods for developing quantitative sensory profiles exist **[6]** and there are examples of application of these to PDO products, such as the method for the organoleptic assessment of extra virgin olive oil, which is used for the designation of origin **[10]**. In the compulsory generic method for the categorisation of the quality of olive oils, the intensity of defects and positive attributes (fruity, bitter and pungent) are quantified on continuous 10 cm scales. The approach proposed by the IOC for the sensory control of PDO extra virgin oils requires the selection and definition of typical characteristics (e.g., almond, artichoke, apple, etc.) to define the sensory profile of each PDO, and the evaluation of these characteristics by a trained panel to confirm if the sensory profile is within the specification limits (intensity limits) established by the PDO.

- ***Direct compliance score* (degree of conformity or trueness to type)**

  There are different methods of this type. Presented here is as an example, the experience of the Sensory Laboratory of the University of the Basque Country (LASEHU). The main consecu-

tive steps in the approach of LASEHU are the following, although some of them can be carried out simultaneously (see **[19]** as example on wine):

- *Sensory attribute generation*: odour, aroma (retronasal), taste, trigeminal sensations and appearance terms are generated by sample-paired comparisons or by simple descriptions of each sample.
- *Selection of the sensory parameters defining the sensory standards for PDO control*: based on the attribute discussion, considering the citation frequency in sensory attribute generation, the parameters reported in the literature and the opinions of the experts of the working group, the sensory standards are chosen. Two main questions are asked to focus the discussion and select the sensory parameters: «Does this parameter really influence the sensory typicity of the product?» and «Does this parameter differentiate among products?».
- *Definition of the «sensory ideal typicity profile, typicity grading and scoring criteria for each sensory parameter»*: for example, a 7-point scale to score each parameter agreed among the experts. The ideal sensory situation (ideal typicity – score 7) is defined by answering this question: «what are the typical characteristics that this product sample must have to be considered the ideal?». Next, the sensory profile characteristics related to scores 6, 5, 4 (not entirely ideal typicality), 3, 2 and 1 (low typicality or sensory defect perception) are discussed. Definition of sensory profiles is carried out through an in depth discussion, where the goal is a consensus among the experts, where as a minimum the majority, or all of the experts, agree. Some cases are characterised by the presence/absence of concrete typical attributes and in other cases by the perceived intensity. Thus, by detailing the scoring criteria, the influence of opinions, personal preferences, or background of each assessor is minimised. To facilitate easier understanding, decision trees can be developed.

The *definition of the sensory evaluation procedure* is determined by consensus among the experts with the aim of homogenising the tasting procedure, so all the assessors evaluate in the same manner and using the same techniques. The evaluation procedure should cover all relevant aspects but be as simple as possible. After defining the parameters/attributes to be evaluated, the scales, the most common attributes and defects, and the order in which to evaluate the parameters, the final score card is developed.

During all sessions of the working group, sensory references are prepared and presented to develop a shared and consistent understanding of sensory concepts among the participants. These references can be used in the subsequent panel trainings.

A.3.3. Training the panel, method validation and monitoring of the performance of assessors

Once the method has been defined, PDO organisation will also be required to:

- Define and apply a specific procedure for the training and qualification of sensory assessors (and periodic individual retraining and requalifying if necessary) in relation to the defined method (*see Part I of these guidelines, section 2.2)*;
- Demonstrate the reliability (validation) of the developed method using trained and qualified sensory assessors (*see Part I of these guidelines, section 4.5)*,
- Monitor the assessors and the panel in each session, ensuring the reliability of the results over time (*see Part I of these guidelines, section 7).*

References

[1] **Muñoz, A.M. *et al.* 1992.** *Sensory evaluation in quality control.* New York: Van Nostrand Reinhold.

[2] **FQAP Special Issue (1995).** *The Definition and Measurement of Quality*. *Food. Qual. Prefer.* 135-213.

[3] **Costell, E. 2002.** *Food. Qual. Prefer.* 13: 341-353.

[4] **Kilcast, D. 2010.** *Sensory analysis for food and beverage quality control: A practical guide.* Cambridge: Woodhead Publishing.

[5] **ISO (2019).** Standard 20613: General guidance for the application of sensory analysis in quality control. Geneva: International Organization for Standardization.

[6] **ISO (2016).** Standard 13299: General guidance for establishing a sensory profile. Geneva: International Organization for Standardization.

[7] **DECRETO MINISTERIALE 12 marzo 2019,** Disciplina degli esami analitici per i vini DOP e IGP, degli esami organolettici e dell'attività delle commissioni di degustazione per i vini DOP e del finanziamento dell'attività della commissione di degustazione di appello. *Gazzetta Ufficiale del 3 maggio 2019, n. 102.*

[8] **Pérez-Elortondo, F.J. *et al.* 2018**. *Food Control* 88: 159-168.

[9] **OJEU (2013).** Commission Implementing Regulation nº 1348/2013 of 16 December 2013, amending Regulation (EEC) Nº 2568/91 on the characteristics of olive oil and olive-residue oil and on the relevant methods of

analysis. Official Journal of the European Union Brussels: Comisión European Commission.

[10] **IOC (2005).** Method for the organoleptic assessment of extra virgin olive oil applying to use a designation of origin. *International Olive Oil Council T.20/Doc. nº 22.* Madrid.

[11] **Barcina, Y. *et al*. 1995**. *Aliment. equipos tecnol.* Octubre: 107-110.

[12] **Arana, I. *et al*. 2015**. *J. Sci. Food Agric.* 96: 2391-2399.

[13] **IDF (1997).** IDF 99C Sensory evaluation of dairy products by scoring. International Dairy Federation. Brussels: International Dairy Federation.

[14] **ISO & IDF (2009).** ISO 22935-3/IDF 99-3 milk and milk products – Sensory analysis – Part 3: Guidance on a method for evaluation of compliance with product specifications for sensory properties by scoring. Geneva: International Organization for Standardization.

[15] **Endrizzi, I. *et al*. 2013**. *J. Sens. Stud.* 28: 14–24.

[16] **Pérez-Elortondo, F.J. *et al*. 2007.** *Food. Qual. Prefer.* 18: 425-439.

[17] **Ojeda, M. *et al*. 2015.** *Food Control* 51: 371-380.

[18] **Etaio, I. *et al*. 2010**. *Food Control* 21: 533-541.

[19] **Etaio, I. *et al*. 2012**. *Food. Qual. Prefer.* 23: 138-147.

[20] **Giudici, P. *et al.* 2009.** *Industria delle Bevande*, 38, 27-49.

[21] **Garavaldi, A. *et al*. 2010.** *Scienza e Tecnica Lattiero-Casearia* 61, 367:379.

[22] **Casabianca, F. *et al*. 2008**. In Produits agricoles et alimentaires d'origine: *Enjeux et acquis scientifiques (pp. 199-213),* Paris, France.

[23] **INAO (2013).** INAO-DIR-CAC-2 Directive du conseil des agréments et contrôles. France: Institut national de l'origine et de la qualité.

Annex B

Examples of sensory control methods applied to specific classes of products using descriptive quantitative approaches

This Annex shows examples of sensory control methods applied to specific product classes that, as stated in the Guidelines and Annex A, can be classified into two categories, both of which use descriptive quantitative approaches, but differ in the kind of scores obtained on the scales of the sensory evaluation scorecard:

- *Intensity of attributes*: extra virgin olive oil, Asiago cheese, Coteau du Layon wine, Navarra asparagus.
- *Compliance score* (degree of conformity or trueness to type): cheese (Idiazabal, Parmigiano-Reggiano), wine (Rioja Alavesa, Txakoli).

B1. Oil

This is an example of the application of *quantitative descriptive sensory analysis* to develop sensory profiles («intensity of attributes» scores). This method is included in the European regulation 1348/2013 **[1]**. It is a generic method applied as compulsory method for the categorisation of the quality grades of virgin olive oils. It consists of evaluating, on continuous 10 cm scales, the intensity of the possible negative attributes (defects) present in olive oil and the intensity of three positive attributes (fruity, bitter and pungent). From the scores assigned by the trained sensory assessors, the median of fruity and of the main perceived defect is calculated and the quality of the olive oil is classified into three possible categories (extra virgin, virgin, lampante).

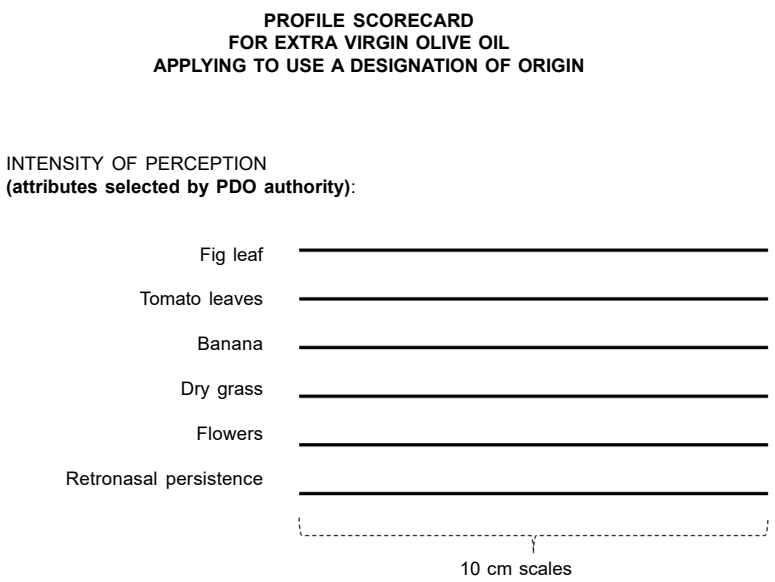


Figure 1. Example of sensory scorecard for sensory evaluation of the conformity of the profile of a specific PDO oil according to IOC method (adapted from **[2]**).

The method proposed by the IOC for determination of the designation of origin for extra virgin olive oils **[2]** is an extension of the generic method developed in two stages:

- *Determination of the sensory profile of PDO*. For this, the IOC document includes a list of attributes of extra virgin olive oils. The PDO must select a maximum of 10 characteristic attributes and will set the maximum and minimum limits of the median of each of them.
- *Evaluation of the conformity of the sensory profile with the characteristic of the PDO*. The olive oil evaluated will be in accordance with the sensory characteristics that define extra virgin oil PDO when its sensory profile is within the specification limits (intensity limits) established in the PDO characteristic sensory profile.

B2. Cheese

B.2.1. Asiago

The sensory control of PDO Asiago cheese is an example of application of *quantitative descriptive sensory analysis* **[3]**. The

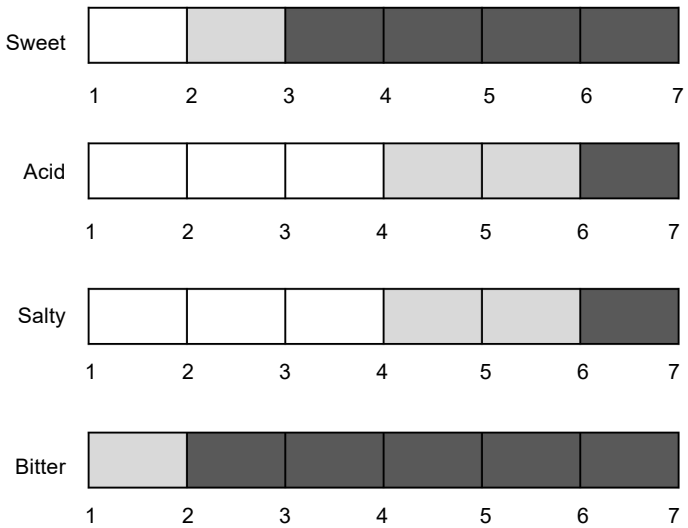


Figure 2. Sensory scorecard for the Asiago cheese (taste section). Intensity of each descriptor has a range of acceptability (white), a range of minor deviation from the accepted values (light grey) and a range on non-conformity (dark grey). Adapted from **[3]**.

intensity of each of the attributes is evaluated on 7-point scale and the conformity of the product is verified on the basis of the conformity ranges previously established for each attribute: a range of acceptability, one of minor deviation from the accepted values, and one of non-compliance (**Figure 2**).

B.2.2. Idiazabal

Sensory analysis method of Idiazabal cheese **[4, 5]** evaluates the eight sensory parameters included in its official specifications: shape, rind, paste colour, eyes, odour, texture, taste and persistence. This method is an example of compliance score approach (*scores of the degree of conformity or trueness to type)*. Trained sensory assessors evaluate if the attributes within each sensory parameter are optimal, suboptimal or defective. Assessors identify the attributes perceived in the product and, with the help of decision trees, score each sensory parameter on a discontinuous 7-point scale, 7 being the maximum degree of adequacy to the optimal sensory profile. Scores 1 to 3 categorise defective sensory profiles and scores 4 to 6 categorise sub optimal sensory profiles (**Figure 3**).

Optimal situation	Non-entirely optimal situation	Defective situation
□ elasticity (low-medium)	□ elasticity high □ does not deform	□ elasticity very high □ does not recover / crumbles
□ firmness (medium-high)	□ soft □ very hard	□ very soft
□ granularity (low-medium)	□ lumpy	□ sandy
	□ small crystals	□ big crystals
	□ adherent	□ very adherent
	□ dry	□ very dry
		□ plastic

Degree of conformity scoring criteria	Score
All the attributes are present in optimal situation	7
One or more attributes are slightly from the optimal situation	6
One or more attributes are quite far from the optimal situation	5
One or more attributes are far from the optimal situation	4
One / several low intensity defects	3
One / several medium intensity defects	2
One / several high intensity defects	1

Figure 3.
Sensory scorecard for the evaluation of the degree of conformity of sensory parameters (texture section) for Idiazabal cheese. Adapted from **[4, 5]**.

In this approach, the scale score allows the median of the degree of conformity for each of the eight sensory parameters to be determined, and based on this, the Control Body can verify compliance with the limits established for the declaration of conformity of the product. In addition, this approach provides PDO producers with a sensory description of their product (attributes and defects), with which they can identify the sensory parameters that can be improved.

B.2.3. Parmigiano Reggiano

The method for evaluation of the PDO of Parmigiano-Reggiano cheese employs a *quantitative descriptive sensory scorecard with compliance score* (**Figure 4**).

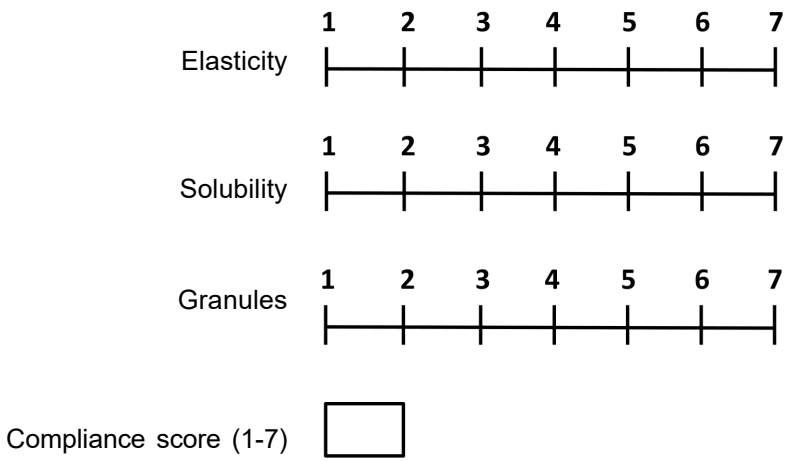


Figure 4. Section of the sensory scorecard for Parmigiano-Reggiano cheese (texture modality). Adapted from **[3]**. Each modality has specific quantitative descriptors and a score for compliance with the pre-established sensory features of the Parmigiano-Reggiano.

The scorecard currently has 24 attributes evaluated on an intensity scale 1-7 plus compliance evaluation of four modalities: appearance, smell, taste (retronasal aroma and taste) and texture, with a minimum accepted value of 3.5. **[6]**. Notwithstanding criticisms of how the compliance score is derived, it has been shown that the compliance scoring system works well when used with a qualified panel of product

experts. When monitoring the panel, the most consistent and the valid data are compliance scores and not those related to the intensity of attributes. Moreover, within data derived using the scorecard for Parmigiano-Reggiano in grated form, which is similar to the one for the product in pieces, good correlation has been shown between the attributes and compliance results **[7]**.

B3. Wine

Some examples are the following:

- **PDO Coteau du Layon wine [3]**: Intensities of specific attributes are scored on scales of 0 to 5 points, each of which has previously established ranges of conformity: range of compliance, potentially non-compliant values and a range of non-compliance.

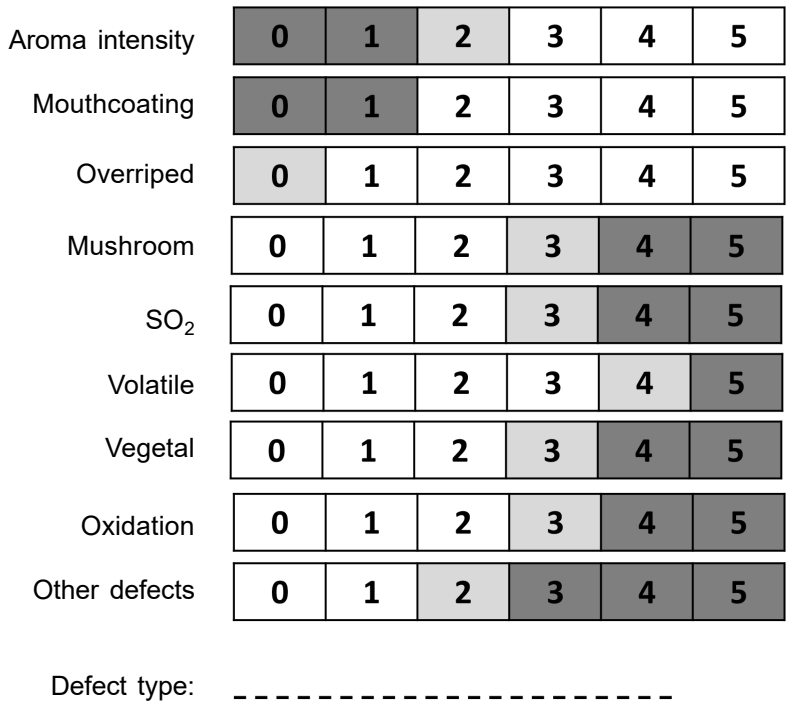
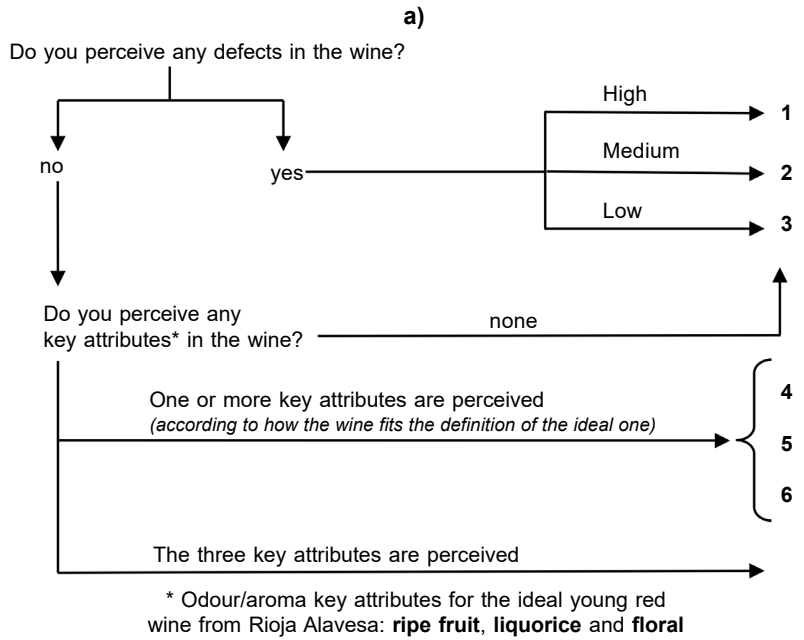


Figure 5. Sensory scorecard for the Coteaux du Layon wine (aroma descriptors). Adapted from **[3]**. Every modality has specific quantitative descriptors and compliance levels are defined (in white, accepted values; in light and dark grey potentially eliminatory values).

- **Vino Rioja Alavesa [8] and txakoli white wine [9]**: LASEHU has applied the same approach as for PDO Idiazabal cheese (see Annex B2) for the development of sensory control method in PDO wines (**Figure 6**).



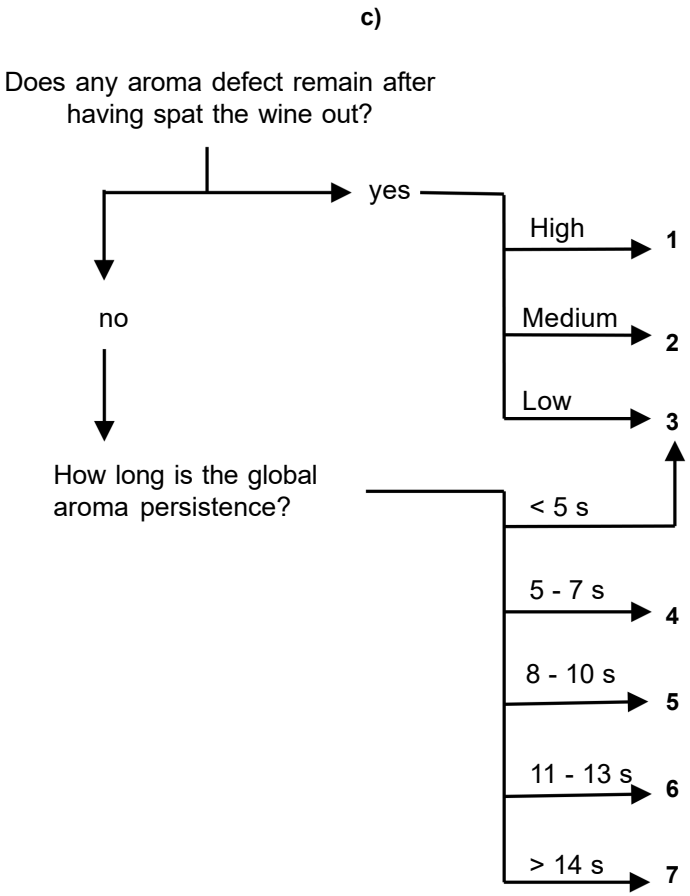


Figure 6. Part of the decision diagrams to score compliance with the pre-established sensory features for the sensory parameters of the Rioja Alavesa young red wine. **a)** Odour (orthonasal) complexity and aroma (retronasal) complexity, **b)** balance and body, **c)** global aroma (retronasal) persistence. Adapted from **[8]**.

B4. Asparagus

Asparagus from Navarra PGI [10, 11]: the assessors rate the intensity of each sensory attribute on a scale (from 0 =absence, to 5 =very intense). After the panel manager transforms the intensities obtained into quality scores, following the quality specifications established by the Regulatory Council (**Figure 7**). This scoring system is also used by the Roncal cheese **[12]**.

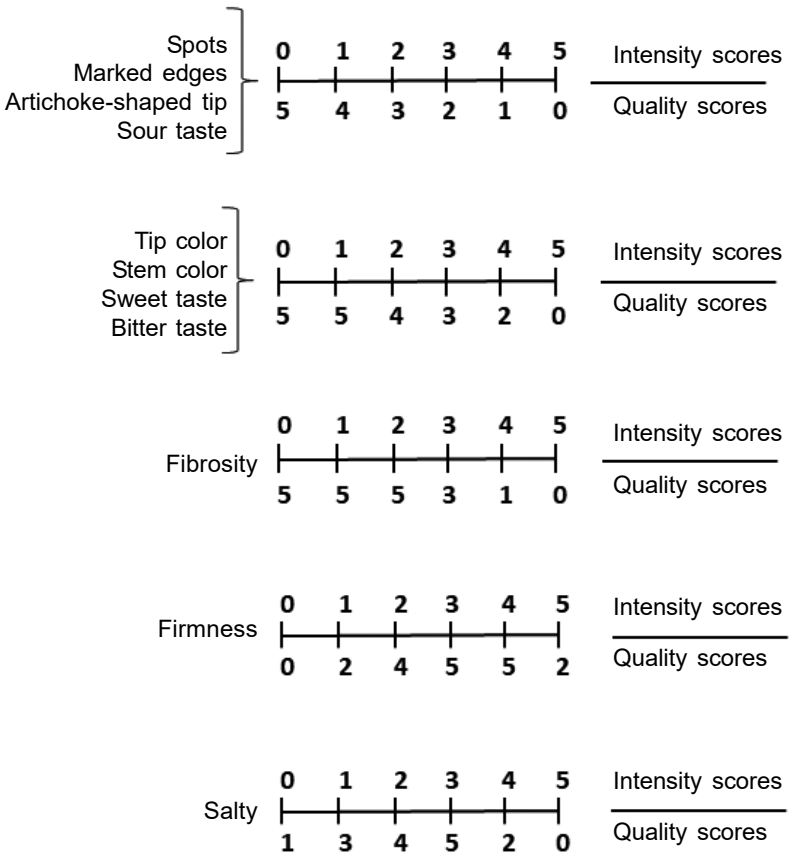


Figure 7. Scales for conversion of intensity scores into quality scores. For each sensory attibute, the top line of numbers is the intensity scale used by the assessors and the bottom line of numbers is the transformation into quality scores (from 0 to 5). Adapted from **[11]**.

References

[1] **OJEU, 2013.** Commission Implementing Regulation nº 1348/2013 of 16 December 2013, amending Regulation (EEC) Nº 2568/91 on the characteristics of olive oil and olive-residue oil and on the relevant methods of analysis. Official Journal of the European Union Brussels: European Commission.

[2] **IOC, 2005.** Method for the organoleptic assessment of extra virgin olive oil applying to use a designation of origin. *International Olive Oil Council T.20/ Doc. nº 22.* Madrid.

[3] **Pérez-Elortondo, F.J. *et al.* 2018**. *Food Control* 88: 159-168.

[4] **Pérez Elortondo, F.J. *et al.* 2007.** *Food. Qual. Prefer.* 18: 425-439.

[5] **Ojeda, M. *et al.* 2015.** *Food Control* 51: 371-380.

[6] **Garavaldi, A. *et al.* 2010.** *Scienza e Tecnica Lattiero-Casearia* 61, 367-379.

[7] **Zannoni, M. & Hunter, E.A. 2015**. *Ital. J. Food Sci*., 27: 487-494.

[8] **Etaio, I. *et al.* 2010**. *Food Control* 21: 533-541.

[9] **Etaio, I. *et al.* 2012**. *Food. Qual. Prefer.* 23: 138-147.

[10] **Barcina, Y. *et al.* 1995**. *Aliment. Equipos Tecnol.* Octubre: 107-110.

[11] **Arana, I. *et al.* 2015**. *J. Sci. Food Agric.* 96: 2391-2399.

[12] **Arana, I. *et al.* 2009.** *Alimentaria* 400: 99-101.

Guidance on how to write the sensory specification of a product for EU PDO registration

Annex C

One limitation identified by the accreditation bodies in the sensory control of PDO food products is the lack of coherence between sensory control scorecards and organoleptic descriptions cited in the EU regulation 1151/12. Sensory scorecards frequently do not include the sensory attributes of the organoleptic description cited in the regulation. This happens because the sensory aspects of many PDO products are poorly specified and, in most cases, the description of PDO products in the regulation has been established without adequate previous sensory evaluation information. On the other hand, although the sensory descriptions are technically adequate, the sensory compliance criteria for the certification of the PDO products are practically non-existent in the regulations.

The aim of this Annex is to give guidance on how to write the sensory description of a PDO product in the product specification according to official regulation.

C.1. Sensory characterisation of the product

Sensory characterisation using descriptive methods should be a prior step to the development of the product specifications of PDO products. It would make no sense to write the product specification of a PDO product without first having described its perceptible sensory characteristics. A possible approach to carry out this work is described *in section 3 of Annex A* of this guide. Aroma wheels developed for many different products are available in the scientific literature to assist in sensory product descriptions.

Selected attributes should describe in an exhaustive but non-redundant way (grouping synonyms, antonyms, intensity levels of the same attributes) the sensory characteristics of the different typologies of PDO products. In general, the final list of attributes is developed via consensus of a working group of experts, considering citation frequency of the attributes and previous scientific publications, if available.

In many cases, it is necessary to develop reference materials so that each participant can understand the sensory characteristic associated with each attribute in the same way. These references (preparation in a food matrix, using chemical compounds, or commercial products) simulate the sensations produced by the PDO product. The perception should be as close as possible to the real situation. Sometimes it is necessary to develop several references of the same attribute (for examples different references for «floral»). In general, consensus is more complicated the more precise the term is. It is easier to reach an agreement at the «family» level («fruity»), than at the «subfamily» level («citrus») or at precise descriptor level («orange») **[1]**. Final sensory attributes included in the description of a PDO product in the official product specification should be:

- *Non-hedonic*: to avoid affective judgements;
- *Discriminant*: an attribute could be discriminant between products qualitatively (present in a product, absent in others), or quantitatively (differences in intensity among products);
- *Measurable* (it must be possible to define and measure it).

Different approaches for sensory characterisation of PDO products are possible. The following are some examples:

C.1.1. Idiazabal cheese

PDO Idiazabal cheese is a traditional food product from the Basque Country (in the North of Spain) made with raw ewes' milk of the autochthonous Latxa breed. This product has a very marked cultural, social, economic, and environmental background **[2]** and its PDO status dates back to 1987. The official sensory control of this product is carried out by a specifically trained panel in the Sensory Laboratory of the University of the Basque Country (LASEHU), which has been accredited following standard *ISO 17025* since 2005.

Since its constitution in 1987, the Regulatory Council of Idiazabal cheese has always shown a special interest in developing activities aimed at increasing knowledge about the specific sensory characte-

ristics of the product and creating standardised methods for its evaluation. The activities in this field can be summarised in the following stages:

- 1990-1991. After an initial period (1987-1989) in absence of any type of precise sensory definition, at the initiative of the Regulatory Council and thanks to funding from the Basque Government, a sensory work project was carried out, which allowed establishment of a generic optimal sensory definition of the Idiazabal cheese **[2].** The objective was to increase consumers' satisfaction compared to their expectations regarding quality, respecting the typical sensory characteristics of the product. For that, it was necessary to define a vocabulary that would describe the wide range of olfactory-gustatory sensations that can be generated in the cheese, and a suitable tasting procedure, selecting the descriptors and determining the intensities of each. To achieve this, numerous meetings and tasting sessions were held over two years. Experts from various groups related to cheese, such as food critics, consumers, chefs, Idiazabal cheese producers and university researchers participated in these sessions.
- 1992-2000. In this period the definition and tasting methodologies developed in the previous sensory work were systematically applied at the facilities of the Regulatory Council. In parallel, sensory studies elucidating the sensory characteristics of the product continued to generate in depth understanding, and these studies of Idiazabal cheese are available in scientific publications **[3, 4, 5, 6].**
- 2000-2020. Collaborations were agreed between the Regulatory Council and the University of the Basque Country for the development of the facilities of the university and continuous improvement of an accredited specific sensory methodology **[7, 8]** for the official sensory control of the PDO product (*see Annex B, section 2.2* of this guide). The scientific knowledge gained in previous phases was essential for developing activities in this period.

C.1.2. Parmigiano-Reggiano cheese

In the case of Parmigiano-Reggiano, sensory analysis approaches existed prior to the Regulation (EEC) 2081/92 for protection of PDO/PGI. During this period, the Consortium for this cheese used a QDA scorecard for research purposes. The scorecard had 24 descriptors with intensity range 1-7 and was used extensively for analysing cheeses from many different cheese manufacturers and was there-

fore well known and accepted by producers. The data gathered with this scorecard, some hundreds of sensory evaluations, allowed the definition of the average values for the product, which were used for specifying the certification mark.

For the purpose of PDO certification, the technical service of the Consortium, used these data to define the range of values of each descriptor to match the desired quality of the PDO: optimal, average and non-acceptable. Determining the compliance of the product with the provisions of the official product specification was difficult because the high number of descriptors and their different intensities could create confusion during the compliance evaluation (i.e., a product could have some descriptors with intensities in optimal range and some in non-acceptable range, making it difficult to classify).

After about one year of testing, it was found that the Consortium panel gave adequate results in terms of compliance scores for the products analysed. The products evaluated with this classification fit well with the specific provisions for the PDO. This scorecard is divided in four modalities: visual, smell, taste and texture. The panellist gives a compliance score (scale 1 min-7 max, minimum acceptable score for PDO is 3.5) (see Annex B2 of this guide).

C.1.3. Asiago cheese

In 2008 the consortium of Asiago cheese decided to introduce sensory analysis in official control. A project divided in three steps was planned: a) general education on sensory analysis, b) practice in sensory analysis, c) pilot study of sensory PDO control. All these phases were carried out with the participation of producers on a voluntary basis.

The first part was organized as follows: a) training course on sensory analysis; b) first phase of experimental sensory evaluation of cheeses; c) presentation of the results of the sensory evaluation; d) second phase of experimental sensory evaluation of cheese. This work was carried out with more than 200 cheeses tested, and participation of approximately half of the producers who had the possibility to taste the cheeses analysed. This work lasted 18 months.

After that, a year of system testing was carried out including sampling and data processing. Then, another training course for producers and a year of PDO sensory analysis control simulation was carried out, in collaboration with the control body without employing the data collected for the PDO official control. Eventually, the PDO sensory analysis was introduced after 5 years of preparation.

As in case of Parmigiano-Reggiano, a QDA scorecard already existed as well as experience with the sensory analysis of this cheese. The entire project assumed the participation of producers. For this reason, it was necessary to develop a simple scorecard that the producers could understand well **[9]**. The scorecard was thus organised with eight descriptors with intensity 1-7 (see the annex B of these guidelines) and a range of acceptability for each descriptor.

C2. How to write the sensory specification of a product for the PDO official regulation

C.2.1. European Union regulation

The introduction of the EU Regulation 1151/12 on quality schemes for agricultural products and foodstuffs (protected designation of origin PDO and protected geographical indications PGI) states in point 47 that «the system verifies compliance with the product specifications».

The article 7 states that:

[a PDO or PGI] «shall comply with a specification which shall include at least:

….

b) a description of the product including the raw materials, if appropriate, as well as the principal physical, chemical, microbiological or organoleptic characteristics of the product;

….

g) …the name and addresses of bodies verifying the compliance with the provisions of the product specification…»

These bodies verifying the compliance are defined in article 39, which states that «Competent authorities may delegate … specific tasks related to official controls of the quality schemes to one or more control bodies. Such control bodies shall be accredited in accordance with European Standard EN 45011 or ISO/IEC Guide 65 «General requirement for bodies operating product certification systems». This standard has been replaced by the *ISO 17065* **[10]**.

Given these statements, it is necessary for a PDO/PGI to have a general description and an organoleptic description of the product. In addition, the control body should be able to verify the compliance of the product with the organoleptic description of the product. In order to comply to this task according to the requirements of the certification body, sensory analysis of the product must be carried out. In order to perform a relevant sensory analysis the organoleptic characteristics described in official document should be clear enough

to allow the creation of a scorecard specific for the PDO. The control body for the compliance of the product via the organoleptic description will then use this sensory analysis procedure during its monitoring of the product.

The European official document for the registration of the name of a quality product includes a *Guide to applicants how to compile the single document* **[11]**.

Point 3.2 in this guide, *Description of the product* gives the following instructions: *The description must give technical, scientific data to describe the specific product. Include the product's specific physical, microbiological, chemical, and organoleptic data ….Use precision and the kind of language that an agronomic scientist or food technologist would use to describe the product.*

The organoleptic description should allow the introduction of a sensory test, which can be used to verify the compliance of the product tested against the organoleptic description. Given these conditions it is not acceptable for the organoleptic description to be generic (i.e., «characteristic taste») as has been the case for some PDO/PGI registered products in the past.

The description should include attributes related to appearance, smell, taste and texture. The terms used for the attributes shall be non-hedonic, discriminant, measurable, and not redundant.

It is advisable not to be too detailed in writing the description to avoid excluding products with variations in defined attributes outside the PDO limits. Only significant key attributes should be included.

C.2.2. Examples of sensory specifications

Specifications for sensory regulation should include a general sensory description of the PDO product, but it could also include compliance criteria (limits of conformity) for the certification of the product. Idiazabal cheese is an example of European PDO food product whose optimal sensory description and sensory compliance limits for certification are included in the EU official regulation **[12]**.

An appropriate sensory description of the product requires the participation of sensory analysis professionals (*see section 3 of the Annex A of this guide*). The decision to establish compliance limits is not a function of the panel. The PDO Council or the competent authority should establish such limits and compliance criteria.

Some appropriate organoleptic descriptions cited in the eAmbrosia, the EU geographical indication register **[13]** and examples of how to translate it into measurable sensory attributes in the sensory evaluation scorecard for sensory control of the PDO products are shown in **Table 1**.

Table 1. Appropriate organoleptic descriptions found in the eAmbrosia, the EU geographical indication register and examples of how to translate these into measurable sensory attributes in the sensory evaluation scorecard.

Olive oil – Greece Elaiolado Makris.	
Organoleptic description in the regulation	Colour: bright yellow-green, becoming golden yellow as it matures. Aroma: medium fruity with a median of Mf > 4, with a scent of herbs, daisies and marigolds when the olive oil is produced from semi-unripe olives, and a dominant scent of camomile when the olives are ripe. Notes of apple and almond harmoniously complement the fruity aroma. Taste: well balanced, with a slightly bitter aftertaste with median bitterness (Mb = 2–3), slightly pungent with median pungency (Mp = 2–3), median defect (Md = 0).
Justification of appropriate description	Description includes attributes related to appearance, aroma and flavour. The terms used are neither hedonic nor redundant, and are measurable and apparently discriminant. Acceptable intensities of descriptors are indicated. It is however necessary to assure a definition of the concept of well balanced.
Translation from organoleptic description into measurable sensory attributes in the sensory evaluation scorecard	**Colour:** yellow-green. **Aroma:** fruity (intensity), herbs, daisies, marigolds, camomile, apple, almond. **Flavour** (intensity): bitter, pungent, acid, no defects. **Aftertaste**: bitter.
Baked dough – Croatia. Varaždinski klipič.	
Organoleptic description in the regulation	External texture: a smooth, firm consistency. Internal texture: soft and tender. When consumed, has a crunchy mouthfeel, with an initial impression of softness on the palate, before melting in the mouth. It has a milky, slightly sour taste.
Justification of appropriate description	Description includes attributes related to texture and flavour. The terms used are neither hedonic nor redundant, and are measurable and apparently discriminant.
Translation from organoleptic description into measurable sensory attributes in the sensory evaluation sheet	**Texture** (intensity): smooth appearance, external and internal firmness, softness in mouth and crunchy. **Flavour**: milky, sour (intensity).
Beer – Lithuania. Kaimiškas Jovarų alus.	
Organoleptic description in the regulation	Colour: the colour ranges from golden yellow to golden brown (amber). Appearance: the beer froths when poured into a jug or glass, usually creating a tall head of thick, white foam. Characteristic turbidity as result of the yeast sediment. Nose: a notable aroma of yeast, bread, caramel and fruit. Taste: an intense, malty beer taste. Characteristic bitter taste of hops with a hint of yeast, berries, caramel, hazelnuts, herbs and citrus fruit. If natural honey is added, there is a hint of honey.

(*Continues*)

Table 1. (*Continuation*).

Justification of appropriate description	Description includes attributes related to appearance, aroma, and flavour. The terms used are neither hedonic nor redundant, measurable and apparently discriminant.
Translation from organoleptic description into measurable sensory attributes in the sensory evaluation scorecard	**Appearance:** colour from golden yellow to golden brown (amber), foam thickness, foam colour, turbidity. **Aroma:** yeast (intensity), bread, caramel, fruit. **Flavour:** malty (intensity), bitter, yeast, berries, caramel, hazelnuts, herbs, citrus fruit, honey (intensity) if honey is added.
Spirit drinks – Mexico. Tequila.	
Organoleptic description in the regulation	Appearance: Light-, medium- or full-bodied, depending on how long the tequila clings to the glass, creating 'tears' or 'legs'. Colour: White tequila is crystal-clear and transparent, with hints of silver. The colour of other tequilas, which may be smoothened, ranges from straw to dark straw, with golden-to-reddish or ochre hues; these other tequilas are aged in direct contact with the wood of common oak or holm oak barrels. **Aroma:** — White tequila: hints of fruity and floral citrus notes. — Young tequila: wood aroma. — Aged tequila: spicy aromas; slightly sweet, vanilla- and butter-tinged tone. — Extra-aged and ultra-aged tequilas: floral and fruity aromas. **Flavour:** — White tequila: cooked agave and pronounced herbal notes. — Young tequila: presence of herbs, cooked agave, raw agave, hints of wood. — Aged tequila: soft, slightly sweet and fruity flavours; slight bitterness and a slight-to-moderate impact from the alcohol. — Extra-aged and ultra-aged tequilas: dried fruit, spices, vanilla, wood, caramel and smoke, with astringency.
Justification of appropriate description	Description of the different typologies of the product includes attributes related to appearance, aroma and flavour. The terms used are neither hedonic nor redundant, and are in general measurable and apparently discriminant.
Translation from organoleptic description into measurable sensory attributes in the sensory evaluation scorecard	**Appearance:** visual body (intensity), turbidity, colour (hints of silver in white tequila; from straw to dark straw, with golden-to-reddish or ochre hues, in other tequilas). **Aroma:** fruity (intensity) and floral citrus (intensity), wood, spicy, vanilla, butter, floral, fruity. **Flavour:** cooked agave, herbal (intensity), herbs, cooked agave, raw agave, wood (intensity), sweet (intensity), fruity, bitterness (intensity), alcohol (intensity), dried fruit, spices, vanilla, wood, caramel, smoke, astringency.

The EU eAmbrosia database also contains organoleptic descriptions, which are far from adequate. For example, in the case of a product, we have found the following organoleptic description: «Distinctive strong flavour meaning that you can enjoy it without salting». Such terms are generic, hedonic and not measurable. Other examples are the organoleptic description of the smell of a product as «A floral and wet-stone palette of aromas that is complex but may be described as neutral», or the sensory description of another product as «Strong, with a balanced mixture of different smells». The sensory terms of these organoleptic descriptions are not precise and thus not measurable.

With inadequate organoleptic descriptions, it becomes very difficult, even impossible, to develop a sensory scorecard for determining compliance to PDO regulation, because there is not clear communication of the sensory characteristics of the product. Even when the organoleptic descriptions are fully adequate it will be necessary to clarify the meaning of some of the terms before their translation to sensory attributes in the sensory evaluation scorecard. For example, «smooth» has different meanings and, if it is not clear in the sensory description, it should be clarified to decide the evaluation procedure (by sight, by hand, in mouth).

In addition, the translation of sensory attribute from original language to other European languages carried out by the EU is done by translators who are not experts in sensory science and thus may not be satisfactory.

In conclusion, it is advisable that when the documentation is prepared for the application of a Geographic Indication to the European Union, the organoleptic description is revised by an expert with knowledge of sensory analysis.

In any case, there are always three questions that we must answer with each candidate term to be included in the sensory evaluation scorecard: *Can it be defined? Can it be measured? Can we find sensory references to clarify the sensory concept to the sensory assessors?*

References

[1] **Berodier, F. *et al*. 1997**. *Lebensmittel Wissenschaft und Technology* **30**: 653–664.

[2] **Pérez-Elortondo, F. J. (1996).** *Sustrai*, 40, 27–31.

[3] **Ordóñez, A. I. *et al.* 1998.** *Journal of Sensory Studies*, 13, 45–55.

[4] **Bárcenas, P. *et al.* 1999.** *Journal Sensory Studies*, 14, 161-179.

[5] **Bárcenas, P. *et al.* 2000.** *Journal Sensory Studies*, 15, 79-99.

[6] **Bárcenas, P. *et al.* 2001.** *Food Science Technology International*, 7, 347-353.

[7] **Pérez-Elortondo, F.J. *et al.* 2007.** *Food. Qual. Prefer.* 18: 425-439.

[8] **Ojeda, M. *et al.* 2015.** *Food Control* 51: 371-380.

[9] **Zannoni, M. & Marangon, A. 2011.** In Cavella S., Di Monaco R., *III Convegno Nazionale SISS - Portici (Napoli)*, 1-2 dicembre 2010, Salerno, 2011, 7-14.

[10] **ISO (2012).** Standard 17065: Conformity assessment - Requirements for bodies certifying products, processes and services. Geneva: International Organization for Standardization.

[11] **European Commission**. Guide to applicants how to compile the single document. https://ec.europa.eu/info/sites/default/files/food-farming-fisheries/food_safety_and_quality/documents/guide-to-applicants-of-single-document_en.pdf (Accessed: April 2021).

[12] **European Commission, 2013**. Amendment application Idiazabal EC No: ES-PDO-0217-01160 – 20.9.2013. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52015XC0227(02)&from=ES Accessed: April 2021. Specifications: https://www.mapa.gob.es/es/alimentacion/temas/calidad-diferenciada/pliegoconmodificacionmenoretiquet22022017_tcm30-377643.pdf (Accessed: April 2021).

[13] **European Commission,** eAmbrosia the EU geographical indication register. https://ec.europa.eu/info/food-farming-fisheries/food-safety-and-quality/certification/quality-labels/geographical-indications-register/ (Accessed: April 2021).

Guidelines for Sensory Analysis of Protected Designation of Origin Food Products and Wines

Sensory evaluation to establish compliance of PDO products in relation with the sensory description in their official specification is a legal requirement for certification according to EU Reg. 1151/2012. Standard methods do not exist, and there are only a few scientific contributions in this area, which makes the task difficult. The wide diversity of methods and practices used creates the need for harmonisation to avoid unfair competition. The European Sensory Science Society (E3S) has become an EA recognised stakeholder, collaborating to prepare guidelines for the harmonisation of methodological approaches and technical criteria to achieve greater uniformity in sensory practices for PDO product evaluation. The purpose of these guidelines is to establish criteria for the development of methodology for sensory analysis of PDO food products and wines.

The European Sensory Science Society (E3S) is a non-profit organisation established in Florence (Italy) on the 12th of May 2011 by thirteen promoting partners, the national sensory societies of Austria, Denmark, Italy, Finland, France, Germany, Norway, Spain, Sweden, Switzerland, The Netherlands, United Kingdom and Ireland.

The goal of the association, concerning general interest and social utility, is to gather, within a single organisation, the European Sensory Science Society (E3S), all national organisations that deal with sensory science and operate in European countries.

Mission: Facilitate the growth of Sensory Science; Promote co-operation, shared goals, integration of activities and knowledge, information exchange amongst national sensory science organisations in Europe; Establish, maintain and enhance the professional status of sensory scientists; Develop and disseminate research, innovation and education in sensory science.

ACRIBIA

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DGSens Deutsche Gesellschaft für Sensorik

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