

1 Current status and perspectives of the official sensory control methods
2 in Protected Designation of Origin food products and wines

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16

17 **ABSTRACT**

18 Protected Designation of Origin (PDO) is part of the regulated quality schemes in the
19 European Union (EU). Producers of PDO food products and wines have to present EU
20 authorities a technical specification of their product, which includes its sensory
21 description. European regulation 1151/12 establishes that sensory characteristics
22 included in PDO certification must be guaranteed. Nevertheless, there is no
23 standardized approach for the development of sensory control methods for PDO food
24 products, so each entity in charge of controlling the characteristics of the PDO products
25 decides the best way to follow this legal requirement. This paper presents the current
26 situation in Spain, Italy and France in relation to the official sensory control of PDO
27 food products and wines and the accreditation of the laboratories for this control (these
28 three countries represent 68.9% of the total PDO products registered in the EU). This
29 manuscript also shows the main methodologies applied in the official sensory control of
30 PDO food products and wines. The wide diversity of methods used for the sensory
31 control and associated panel management among PDOs manifests the need to
32 harmonize technical criteria and references at European level. This is also urgent,
33 because broad differences in the approaches and requirements for sensory control could
34 bring about unfair competition among PDOs. In this sense, European Sensory Science
35 Society (E3S) has become an EA recognized stakeholder collaborating in a framework

36 in order to prepare a document for the harmonization of methodological approaches and
37 technical criteria for the sensory control of PDO food products and wines.

38 **1. Introduction**

39 The origin of regulated quality schemes in European Union (OJEU, 2012), such as
40 Protected Designation of Origin (PDO), has been in response to demand from producers
41 and consumers. PDO food products are wines (as listed in E-Bacchus EU database) and
42 other food products (as listed in EU Database DOOR). PDOs have an important social
43 role because they constitute a relevant element of culture, identity and heritage,
44 preserving the landscape and contributing to the development and sustainability of rural
45 areas, protecting them from depopulation. The proliferation of this EU policy
46 instrument across Europe is likely to increase in the future (Grunert & Aachmann,
47 2016). In general, consumers show a favorable attitude towards such products, generally
48 find them especially attractive and evaluate them positively, although today the role of
49 quality labels in European consumer decision-making is relatively small (Grunert &
50 Aachmann, 2016). In this sense, PDO organizations, such as *Regulatory Council* in
51 Spain, *Consortium* in Italy and *Defense and Management Organization* in France, have
52 to help consumers by giving them information concerning the specific characteristics
53 (typicality, not only sensory) of the products.

54 Sensory characteristics are quoted by the EU regulation 1151/12, which deals with
55 PDO. The producers of PDO products have to present to the EU authorities a technical
56 specification of their product including the sensory description (OJEU, 2012) to be sold
57 with this denomination. This European regulation also establishes that sensory
58 characteristics included in PDO technical specification must be guaranteed. “Official
59 sensory control” is used to verify the compliance of the product with these defined
60 sensory characteristics. In each European country, independent control bodies verify
61 that a product complies with the corresponding product specification. Currently, there is
62 no common agreement on how to perform the external control of PDO products; while
63 in some countries it is carried out by government officials, in other countries it is done
64 by private certification firms. Regarding the control of sensory features, currently there
65 is no standardized approach or European guide for the development of sensory control
66 methods for PDO products, so each entity in charge of controlling the characteristics of
67 the PDO products decides the best way to meet this legal requirement. The bodies in
68 charge of controlling PDOs should be accredited in accordance with ISO norm 17065

69 (ISO, 2012a). Accreditation means the demonstration of technical competence and, in
70 the case of the laboratories, it is based on ISO norm 17025 (ISO, 2005), which is the
71 current frame used for comparable evaluation of testing activities.

72 Typicality (not only sensory) is given by a specific origin including the raw material,
73 the traditional practices and the know-how of the producers that confer specific
74 characteristics onto the final product (Letablier & Nicolas, 1994; Casabianca et al.
75 2008). To address the sensory typicality of the products it is necessary to perform
76 sensory analysis. Although specifications of physical-chemical characteristics are useful
77 to classify products in specific categories, they are not enough to define their perceptible
78 typical characteristics. If sensory specificity of the product is recognized as one of the
79 basic assumptions of the success of a PDO product on the market (Barjolle &
80 Sylvander, 2003), then it is logical to consider sensory analysis as an essential tool in
81 evaluating and differentiating the PDO product from other products in the same food
82 category. Sensory evaluation has proved to be a useful tool to describe the sensory
83 characteristics of PDO products and evaluate their typicality (Maitre et al., 2010).
84 However, how should producers establish the sensory description? There are very few
85 contributions about this topic in the scientific literature. According to the approach of
86 some authors, sensory characteristics must be defined by a consensus among the
87 producers (Casabianca et al., 2008), with the important participation of experts with
88 great knowledge of the product and sensory professionals (Pérez Elortondo et al., 2007).

89 The basic document for the application of the ISO 17025 criteria on PDO food
90 products (and, in general, in food and non-food products) regarding sensory laboratories
91 is the European guideline EA 4/09 (EA, 2017). However, this guideline is not an official
92 document, but only informative/illustrative. The content of this document is very
93 general and specific sensory information (for example, vocabulary, reference standards,
94 criteria for training and performance of the panel) is not included. One limitation
95 identified by the accreditation bodies in the sensory control of PDO food products is
96 that the scorecards frequently do not include the attributes cited in the EU regulation
97 1151/12. The regulations are poorly specified for the sensory aspects; thus, the selection
98 of descriptors to include in the scorecards is a critical point. Furthermore, it is not clear
99 who should determine the suitability of a specific product according to the results from
100 sensory analysis. Very often, the inspection body has no criterion to evaluate the results
101 of sensory analysis.

102 The aim of this paper is to present the current situation in relation to the accreditation
103 of sensory laboratories and the official sensory control of PDO food products and wines
104 in the three European countries where such controls are commonest (Spain, Italy and
105 France). This manuscript also shows some examples of methodological approaches
106 applied in the official sensory control of PDO products, discussing their advantages and
107 disadvantages. This information will help to carry out a European guide for the
108 development of official sensory control methods for PDO products.

109 **2. Official sensory control of PDO food products**

110 Today, 3140 products are registered in EU Database DOOR and E-Bacchus EU
111 database and 60.9% of them are PDO products (Table 1). Within PDO products, 67.5%
112 are wines. Italy, France and Spain represent 68.9% of the total PDO products registered
113 (59% of the non-wine PDO products and 73.5% of the PDO wines).

114 In 2015, the PDO work-group of the European Sensory Science Society (E3S)
115 organized a survey in the mentioned three countries in order to gather information about
116 the use of sensory analysis in evaluating the compliance of PDOs with the respective
117 official regulation. The purpose of the E3S survey was to collect information about
118 who, where, how and why sensory analysis for official control of PDO products is
119 carried out. During this research, information regarding experience on evaluation of
120 sensory practices of Spanish and Italian accreditation bodies and INAO (*Institut*
121 *National de l'Origine et de la qualité*) in France were also considered.

122 Table 2 shows the questionnaire used in the survey. Inquiry was addressed to
123 organizations of producers, certification bodies, researchers on PDO products, sensory
124 panel leaders working on PDO products, technical assistance services for PDO
125 producers and individual PDO producers.

126 A summary of the results of the E3S survey about the official sensory control of
127 PDO food products in Europe is shown in Table 3.

128 *2.1. Spain*

129 According to EU Database DOOR, the number of PDO food products other than
130 wine registered in Spain in 2017 is 102 (Table 1). The largest number of non-wine
131 PDOs corresponds to olive oil, cheeses, vegetables, fruits, fresh meat, bakery and pastry
132 products. The number of PDO wines registered is 100.

133 *2.2.1. Spanish PDO using sensory analysis*

134 Since the year 2000 the Spanish accreditation body (*Entidad Nacional de*
135 *Acreditación*, ENAC) has developed more than 200 evaluations of sensory laboratories
136 in ISO 17065 norm and/or ISO 17025 norm accreditation schemes (Gredilla, 2015).
137 There are 115 PDO/PGI food products in Spain certified according to ISO norm 17065
138 using sensory evaluation: 84 wines, 14 olive oils, eight cheeses, two spirit drinks, two
139 hams, one butter, one *sobrasada* (raw cured sausage), one saffron, one paprika and one
140 vinegar. In December 2017, there are 30 sensory laboratories accredited in Spain: 21 of
141 them are accredited for the application of the official generic sensory control method for
142 the quality categorization of olive oil (EU regulation 2568/91 Annex XII and further
143 modifications) and three laboratories have an internal generic procedure for the sensory
144 description of wine. Sensory methods for other specific food products are scarce: one
145 for ham (Serrano ham Traditional Speciality Guaranteed, TSG), two for DOP cheeses
146 (Roncal and Idiazabal), one for young red wine from Rioja Alavesa, one for txakoli
147 white wine (Basque Country wine) and one for cider (Basque Country “natural” cider).
148 In general, sensory evaluation of PDO wines is made by the control bodies but without
149 accreditation of the analysis.

150 2.2.2. *E3S survey*

151 Results of the survey (Table 3) show important differences between accredited and
152 non-accredited sensory panels in terms of training of assessors and monitoring their
153 performance. The reason for using sensory analysis is mainly due to legal requirements,
154 the need for PDO certification, in some cases due to product sales requirements
155 (identification of defects) but rarely to product quality improvement. Some certification
156 bodies complain that there are not enough accredited laboratories available.

157 2.2. *Italy*

158 There are 474 PDO wines in Italy (Table 1). The sensory evaluation to check their
159 compliance with the PDO requirements is carried out by commissions of tasters from
160 the local chambers of commerce (decree n. 295/2011). This system is considered
161 obsolete by Italian accreditation body, but it is still in use. Italian PDO food products
162 other than wine are 166.

163 2.2.1 *Italian PDO using sensory analysis*

164 The answers to the questionnaire showed that all the PDOs of olive oil use the
165 sensory analysis as foreseen by the EU regulations. Among the other products, as far as
166 we know, there are 17 PDOs (18 including Aceto Balsamico di Modena PGI) that use

167 sensory analysis as a tool for PDO certification (i.e. 7.5% (7.9%) of the total number). It
168 is possible that some other PDOs use sensory analysis in Italy.

169 Most products are controlled by means of organoleptic tests carried out by inspectors
170 of the control bodies during inspections.

171 PDOs using sensory analysis include 46 oils and one fat, five cheeses, four cured
172 meat products, three other products of animal origin (honey), two fruit and vegetables,
173 and two other products.

174 The bodies in charge of sensory analysis for oils are 12 chambers of commerce and
175 two public authorities plus eight private control bodies (these 22 bodies control 46 PDO
176 products). Among the bodies dealing with the non-oil products there are three
177 certification (control) bodies, three accredited laboratories appointed by certification
178 bodies, two non-accredited laboratories appointed by certification bodies and two
179 consortium laboratories under the control of certification bodies.

180 2.2.2. *E3S survey*

181 The most common systems for scoring use a quantitative descriptive analysis (QDA)
182 sheet ([Table 3](#)): seven PDOs use a compliance score approach, and five use an intensity
183 acceptance range for specified descriptors. The most frequent situation is that of PDOs
184 with organoleptic tests carried out by the experts of the control bodies during
185 inspections. The panel size is about 8-12. The quantitative scales are mostly 1-7 and 1-9
186 points. Training and control of panel performance is done according to different norms:
187 nine PDOs (three with proficiency testing) according to general ISO norm 8586 ([ISO,](#)
188 [2012c](#)), two PDOs according to ISO norm 9001 ([ISO, 2015](#)), two PDOs using internal
189 methods and four PDOs not known. Besides, in Italy, there are three active proficiency
190 test networks for oil, cheese and honey.

191 The analytical laboratories are internal to the control bodies as in the case of most
192 oils, and there are also some external laboratories accredited, some external laboratories
193 non-accredited and, in some cases, the consortia have an internal laboratory but
194 managed by the inspection body.

195 2.3. *France*

196 In this case, there are 475 PDOs ([Table 1](#)). The majority of them (376) are wines and
197 the other PDOs (99) are mainly dairy products.

198 2.3.1. *French PDO using sensory analysis*

199 With regard to sensory evaluation, in contrast with Italy or Spain, no evaluation of
200 sensory analysis practices has been developed by the French accreditation body; in

201 France, an official text from INAO defines the rules for the committee in charge of
202 evaluating PDO products (INAO, 2013). This regulation allows a harmonization of
203 practices among the PDOs. Notably, it defines the characteristics of assessors involved
204 in the evaluation: they have to be from three different groups (“bearer of memory”,
205 technicians and product users) and they should be trained in identifying the specificity
206 of the products and their main defects.

207 Then, sensory evaluation for the compliance with PDO specifications is done under the
208 responsibility of the Defense and Management Organizations (DMO). Each DMO
209 decides the final methodology to follow for the sensory evaluation (sensory attributes,
210 environmental conditions, number of assessors...). Some DMOs delegate this to
211 Control Organisms (CO) divided into two types: Inspection Organisms (IO) (ISO,
212 2012b) or Certification Organisms (CO) (ISO, 2012a). The IOs examine the conformity
213 of the product with the specifications and transmit the results to the INAO, which
214 decides whether action should be taken. IOs can control only wine products. The CO
215 certifies that the content of the specifications has been respected and, when
216 inappropriate, penalizes its non-compliance.

217 2.3.2. E3S survey

218 The E3S survey (Table 3) was carried out on 46 PDOs from the around 465 PDOs
219 recognized in France but with an under-representation of the wine category. Some COs
220 were also interviewed. It appears that majority of assessment committees are based on
221 five to 12 qualified assessors by session.

222 The methods covered by the survey are mainly based on defect recognition and
223 quality perception with comments, and rarely on sensory identification of precise
224 attributes. Similar approaches are observed in numerous PDOs of the same product
225 category even if the attribute lists and methods differ in some aspects. Scorecards use
226 attributes with different level of precision, but sensory description is generally done by
227 global sensory parameters (appearance, odor, texture, taste). As evaluation focuses to a
228 great extent on defect identification, judges are primarily trained in defect recognition.
229 Tasters have also to specify if the product is acceptable or not in the PDO. The final
230 decision is more often based on consensus among judges than on statistical analysis. For
231 meat, tasting methods seem to be more diverse due to the complexity of fresh meat.

232 In relation to panels, some problems have been identified: the recruitment of
233 assessors is a problem to solve, analysis of judges’ performance is carried out in
234 different manners and it is difficult to establish a minimum required level of

235 performance. The control organism for each PDO verifies the ability of the judges.
236 Several strategies are applied for performance evaluation. Some laboratories use
237 replicates whereas others include products with defects. Unlike Italy or Spain, none of
238 the respondents mentioned ISO norm 8586 (ISO, 2012c). Concerning the evaluation
239 environment conditions, very little information was collected during the survey. It
240 would be interesting to verify if the sensory recommendations given by the DMOs are
241 followed.

242 Moreover, it has been observed that it is difficult to harmonize some criteria between
243 product families or among products from the same family due to the high levels of
244 diversity and variability. For example, in the context of the defects of PDO products,
245 there can be typical defects (related to the raw materials, processing...) and non-typical
246 defects related to the use of industrial technologies; therefore, the importance of the
247 defect detected depends largely on the type of defect and product.

248

249 **3. Some examples of methodological approaches applied to official sensory** 250 **control of PDO food products**

251 Different sensory methods for the PDO control are currently used in Europe. These
252 include identification of the presence of defects, yes / no judgment, citation frequency
253 of defects and positive characteristics detected over a list of attributes provided, or use
254 of scales to score attribute intensities and calculate the medians or means.

255 The perfect solution does not exist and several different methods may be acceptable
256 at European level. In any case, those who choose a method should validate and
257 demonstrate its effectiveness. Obviously, the method selected should be adapted to the
258 specific sensory characteristics of the PDO product.

259 Methods applied in Europe could be classified in two groups: generic methods for
260 categories of food products (oil, wine) and specific methods for food products within a
261 category (for example, a specific PDO cheese).

262 *3.1. Generic methods for categories of food products*

263 *Oil*

264 Across the EU, PDO olive oils are analysed using the International Olive Oil Council
265 (IOOC) sensory method. EU Regulation No. 1348/2013 includes an annex called “XII:
266 Method for the organoleptic assessment of virgin olive oil”. This method employs a
267 quantitative-descriptive profile sheet with the intensity of positive and negative
268 attributes. The classification of the oil is carried out using the median value of the

269 specific defects and the median for the fruity attribute. The olive oil PDOs surveyed in
270 Spain, Italy and France use this generic method in accredited laboratories. Despite this,
271 as far as we know, none scope of accreditation of the olive oil PDOs considers the
272 evaluation of specific sensory attributes of the corresponding oil by using, for example,
273 the normalized approach proposed by the IOOC for this purpose (IOOC, 2005).

274 *Wine*

275 For wines, the only official tool is the OIV (International Organization of Vine and
276 Wine) competition sheet (OIV/Concours 332A/2009) but quality categories of each
277 sensory parameter are not very detailed or objectively defined. In relation to how
278 sensory results guarantee compliance with PDO requirements, a minimum overall
279 quality score is considered based on a mathematical weighting of the various sensory
280 aspects included in the sheet.

281 *3.2. Specific methods*

282 *Idiazabal cheese*

283 Idiazabal cheese is, as far as we know, the only European PDO food product whose
284 sensory description and limits of sensory conformity for certification are included in the
285 public official regulation recognized by the EU. Today, the sensory analysis of Idiazabal
286 cheese is considered by the Italian and Spanish accreditation bodies as one of the best
287 practice in Europe because it exemplifies an “ideal” process divided into four steps: 1)
288 participation of professionals with great knowledge about the product, 2) characterize
289 the product, 3) prepare a technical document with acceptance limits, 4) include the
290 sensory limits in European official regulation.

291 Sensory method for the official control of Idiazabal cheese was developed ([Pérez](#)
292 [Elortondo et al., 2007](#); [Ojeda et al., 2015](#)) and is systematically applied in the sensory
293 laboratory of the University of the Basque Country (LASEHU). This official sensory
294 quality control employs a scorecard including eight sensory parameters. For each
295 sensory parameter, the “top” sensory situation is defined, as well as different quality
296 categories related to the sensory characteristics perceived in the product. A 1-7 quality
297 scale is used, where 1-3 range covers the situations where defects are perceived, 4-6
298 range covers non-defective but non-optimum situations and 7 points is the top score,
299 fully correct. According to this approach, characteristics of typicality or key desirable
300 descriptors of the product should be considered when describing the “top” situation. The
301 eight sensory parameters are scored according to a decision tree diagram in function of
302 the perception of specific sensory characteristics ([Fig. 1](#)). This approach is also applied

303 to other products, such as young red wine (Etaio et al., 2010a, 2010b), txakoli wine
304 (Etaio et al., 2012) or meat (Etaio et al., 2013).

305 This approach makes it possible to evaluate the sensory quality of a PDO food product
306 in a rigorous and reliable way considering not only possible defects, but also typicality or
307 key descriptors. Collection of attribute/defect citation frequency by the panel can be an
308 effective tool to determine the perception degree of an attribute/defect in the product.
309 These frequencies complement the information provided by the mean scores of each
310 sensory parameter and make a detailed sensory description of the product possible in
311 order to know the reasons for the score of each parameter (the weak and strong aspects).

312 *Serrano ham*

313 For sensory evaluation of Serrano ham (a Spanish TSG, product), a scorecard with a
314 6-point quality scale (defective grading, from “1 - best situation to 6 - worst situation”)
315 for each of the 11 descriptors considered (lean meat color, color homogeneity, shiny
316 appearance of fat, rind appearance, odour, flavour, salty, texture homogeneity, fibrosity,
317 pastiness, softening) is used (Fig. 2).

318 There are no clearly established criteria of compliance for this product, so laboratories
319 or certification bodies have to define limits of acceptance for each attribute as a
320 commercial matter.

321 *Parmigiano – Reggiano cheese*

322 Since 1999, the PDO of Parmigiano-Reggiano cheese has employed a QDA
323 scorecard with compliance score (Garavaldi et al., 2010; Zannoni & Hunter, 2015). The
324 card has nowadays 11 descriptors evaluated in a 1-7 intensity scale plus compliance
325 evaluation of four parameters (appearance, smell, taste and texture) in a 1-7 scale, with
326 a minimum accepted value of 3.5 (Fig. 3). Even if there were critiques about how
327 setting the compliance score, the employment of a trained panel of product experts
328 showed that the compliance scores perform well. When monitoring the panel, the most
329 consistent data are those about compliance scores and not those about the intensity of
330 descriptors.

331 *Asiago cheese*

332 The Asiago cheese scorecards have descriptors with specific intensity ranges for
333 compliance with the PDO requirements (Fig. 4). The sensory characteristics to be
334 assessed and the methodology are described in detail in the control plan.

335 According to the Italian accreditation body, this is one of the best systems of PDO
336 sensory analysis for accreditation purposes.

337 This method has nevertheless a weakness: the text about the sensory characteristics
338 in the official technical document is different from the descriptors used in the scorecard
339 of the control plan, so that in the event of any dispute over a product considered not
340 acceptable by sensory analysis, the position of the control and accreditation bodies is
341 weak because the valid document in court is the technical document and not the control
342 plan. Nevertheless, the Asiago system works well because the parameters thus identified
343 are certifiable and the aim is to change in the future the official documents deposited.

344 *Coteaux du Layon*

345 Coteaux du Layon wine PDO uses a scorecard based mainly on defect recognition.
346 Each attribute is scored on a 6-point intensity scale (Fig. 5). Fourteen attributes are
347 relative to defects and six attributes to the presence of specific qualitative sensations
348 such as odour and aromatic intensity or notes of “overmaturity”. Finally, assessors have
349 to evaluate the balance of the wine and, if necessary, they identify precisely the type of
350 imbalance perceived (sour, sweet, warm...). On each scale, some values are
351 eliminatory. Some intermediate scores (Fig. 5) are eliminatory only if there are at least
352 four attributes in this situation. At the end of the evaluation, a ruling to define the
353 compliance of the wine with the specifications is given based on the scores from the
354 assessors.

355 *Honey from Corsica*

356 A minimum of five assessors from the three different groups established by INAO
357 regulation and mentioned in 2.3 section are used. They are trained mainly in defect
358 recognition by DMO via an external company. The evaluation is based mainly on
359 qualitative descriptions of appearance, odour, taste and texture dimensions (Fig. 6).
360 Then, a quality score is given based on the presence of defects scored on a 7 point scale
361 from “Very good honey without defects” (7) to “Very bad honey with defects” (1).
362 Moreover, assessors mention if the product complies with the stated category (varietal
363 type) of honey.

364 *3.3. Discussion: advantages and disadvantages of the different approaches*

365 The main approaches used today for the sensory control of PDO food products and
366 wines are shown in Table 4.

367 There are methods that do not describe the products, but only identify defects. In the
368 case of descriptive methods, there are two main approaches: identification of attributes
369 (“positive descriptors” and “defects”) or quantification of the intensity of attributes. In
370 the case of attribute identification, the information is semi-quantitative (citation

371 frequencies). It is an easier approach for training assessors than quantification by scale;
372 by contrast, the difficulty is to apply statistical criteria to develop compliance
373 specifications because the number of data available is low (5-12 assessors). In the
374 approach of quantification of the intensity of attributes in continuous or discontinuous
375 scales training of the assessors is difficult, but it is possible to apply statistical criteria to
376 develop compliance specifications in a easier way. In both these approaches used for the
377 sensory control of PDO food products and wines, scales vary from 3 points to 10 points.
378 Some of the methods applied for the sensory control of PDO food products, mainly
379 cheeses, consider the description (quantitative or semi-quantitative) of the product and
380 the compliance or quality scores on separated or integrated scales. In the case of
381 separated scales, the compliance score allows one to know how much the product
382 deviates from the established sensory specifications. In this case, external checks and a
383 relatively long training for compliance evaluation are required. For the use of a
384 compliance or quality scale that integrates qualitative descriptive information, a
385 previous defined sensory description of the compliance or quality is required.

386

387 **4. Conclusions**

388 It is difficult to know how the sensory tests for the official sensory control of PDO food
389 products are carried out in practice. Many producers' organizations are satisfied with
390 sensory tests for exclusively defect recognition and, often, recruitment and training of
391 the panel is underestimated. Methods and scorecards are different both within and
392 among the countries.

393 With the exception of France, the only sensory analysis harmonized in Europe is that
394 one related to the olive oil, based on the methodology published by the IOOC. The wide
395 diversity of methods used for the sensory control of PDO products and associated panel
396 management both within and among countries makes it necessary to develop
397 harmonized technical criteria and references at a European level. This harmonization is
398 increasingly urgent because wide differences in sensory evaluations bring about unfair
399 competition among PDOs. In Europe the organoleptic characteristics of PDOs are
400 quoted in EU official documents and, theoretically, they have to be controlled. The
401 sensory control has a cost and gives to the consumer a better guarantee of the
402 conformity of the product with its officially defined characteristics. If in one country a
403 class of product (i.e. cheese, cured meat, etc.) is controlled by sensory analysis and in
404 another country this is not done, this leads to unfair competition.

405 According to needs informed by accreditation bodies after 17 years of experience,
406 the prospective activities should include technical aspects related to the specific control
407 of PDO food products, such as: i) standardization of valid sensory methods to use them
408 as reference systems, ii) database of references for sensory descriptors (including
409 defects), iii) publication of technical standards for training and monitoring the
410 performance of assessors, iv) technical recommendations to contribute to avoid the use
411 of inappropriate sensory terms and concepts in technical documents filed in EU PDO
412 regulations.

413 In Europe, there is a working group about food inside the association of the
414 accreditation bodies (European cooperation for Accreditation, EA), where these
415 prospective activities on harmonization of sensory analysis application to control of
416 PDO food products could be promoted. E3S, as society of European associations of
417 sensory analysis, has become an EA recognized stakeholder collaborating in a
418 framework to contribute to the preparation of a document for the harmonization of
419 methodological approaches and technical criteria for the sensory control of PDO food
420 products.

421 The harmonization of practices within families of products presenting high diversity
422 and variability requires the establishment of some specific technical criteria. Wine, olive
423 oil, cheese and meat products are the main European PDO food products that require the
424 application of sensory analysis. Practical problems related to the organization and costs
425 of the sensory part of the inspection bodies should not be overlooked.

426

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437

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495 **Table 1**

496 **Total number of PDO, PGI and TSG as listed in EU Database DOOR and E-Bacchus EU database**
 497 **and number of registrations (and percentage with respect to the total) in Spain, Italy and France**
 498 **(April 10, 2017)**
 499

	EU DOOR	Spain	%	Italy	%	France	%
PDO, PGI and TSG (non-wines)	1390	194	14,0	291	20,9	240	17,3
PDO (non-wines)	622	102	16,4	166	26,7	99	15,9
PGI (non-wines)	713	88	12,3	123	17,3	140	19,6
TSG (non-wines)	55	4	7,3	2	3,6	1	1,8
	E-Bacchus EU	Spain	%	Italy	%	France	%
PDO and PGI wines	1750	144	8,2	603	34,5	451	25,8
PDO wines	1291	100	7,7	474	36,7	376	29,1
PGI wines	459	44	9,6	129	28,1	75	16,3
Total PDO, PGI and TSG	3140	338	10,8	894	28,5	691	22,0
Total PDO	1913	202	10,6	640	33,5	475	24,8
Total PGI	1172	132	11,3	252	21,5	215	18,3

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505 **Table 2**

506 **Survey (questionnaire) used by the PDO working subgroup “methods and accreditation” from E3S**

507 Name of the product:

508 Category: ...

509 (i.e. wine, spirit drinks, cheese, fresh meat, meat product, fruit and vegetables, oils and fats, fish, beer,
510 bread and pastry, other products of animal origin, other products -i.e. vinegar, cider, saffron, salt).

511

512 First question: Is sensory analysis with a panel carried out?

513

514 If YES:

515 Who does perform the sensory analysis (organization in charge of the panel)?

516 Which is the size of the panel?

517 Which type of scorecard is used?

518 How do the results guarantee the compliance with the sensory description (i.e. there is a score, a yes/no
519 system)?

520 Has the panel undergone a specific training?

521 How are the performances of the panel checked?

522

523 If NO:

524 Is there any other sensory test (i.e. a test carried out not by a trained sensory panel; for example a test
525 done by a production expert or by a couple of experts in production warehouse, or by three technicians,
526 etc...)?

527

528 If NO:

529 Stop.

530

531 If YES:

532 Is the sensory test carried out only by one expert?

533

534 If YES:

535 Stop

536

537 If NO

538 How many sensory experts do take part?

539 Which organization do the experts belong to?

540 Which type of sensory control is carried out (visual, olfactory-gustative, tactile, and
541 auditory)?

542 How is the compliance guarantee expressed?

543 How is the performance of experts guaranteed?

544

545 Final question (open question)

546 Why do you/don't you use sensory analysis in official control to verify the sensory compliance of the
547 product with the characteristics mentioned in the official regulations recognized by the European Union?
548 (Please list the reasons)

549

550 For the interviewer:

551 *Please quote the source of information (producer, producers' organization, local government, etc.) and*
552 *the way of collecting the information (oral interview, e-mail, internet site, etc.).*

553

554 Compilation date and compiler name.

555 *Note: the questionnaire can also be partially filled out even if some details are not available (i.e. the*
556 *person who answers does not know some details, like the size of the panel or how performance of expert*
557 *is guaranteed etc...). Useful documents (i.e. a scorecard, a regulation...) can be attached to the*
558 *questionnaire.*

559

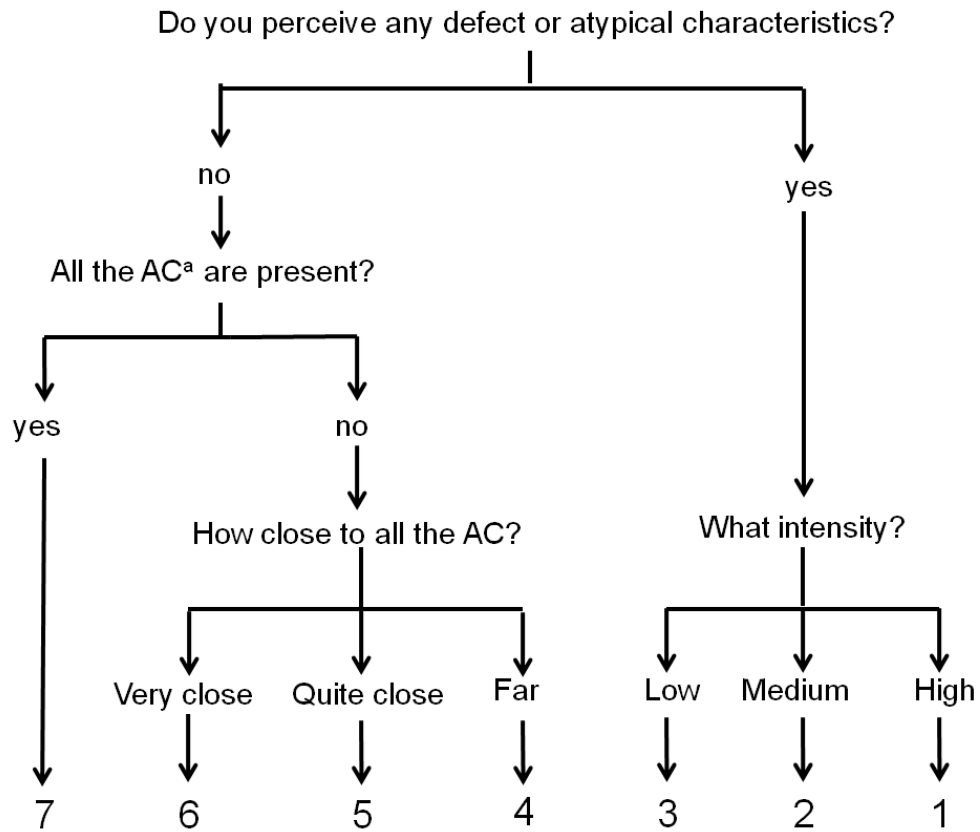
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561 **Table 3**562 **Results of the E3S survey about the official sensory control (methods and accreditation) of PDO food**
563 **products in Spain, Italy and France.**
564

Questions	Spain	Italy	France
Number of questionnaires and products where sensory analysis with a panel is carried out	15 (7 wines, 7 cheeses, 1 olive oil)	14 (5 cheeses, 4 meats, 2 fruit and vegetables, 2 other products, 1 olive oil and 1 fat)	46 (4 meats, 13 cheeses, 3 oils and fat, 6 fruits and vegetables, 1 seafood, 1 spices, 16 wines and alcoholic beverages, 2 others)
Organization in charge	Control bodies (<i>Consejos Reguladores</i>), universities, research centres, private labs	Commissions of tasters by the local chambers of commerce (wine), 2 public authorities, 8 private control bodies	PDO organization (an official text from INAO defines the rules for the committee for tasting of the PDO product)
Number of participants in the panel	5-8	5-12	5-12
Scorecard	Scores (variable, from 3 to 10 points) Yes/no presence of descriptors (citation frequencies)	Scoring using a QDA sheet (scales 1-7 and 1-9, also continuous scale) , Yes/no presence of descriptors	Defect recognition and quality perception with comments
Panel training and checking the performance checking	Differences between accredited and non-accredited sensory panels. In accredited panels checking performances of the individual panelist and the panel for each assessor discriminatory capacity, agreement with the panel, repeatability.	According to ISO norms (8586), internal methods. In some cases (oils, cheeses and honey) proficiency tests.	Replicates, Outliers, Evaluation of the scores compared to the panel average. Consensus between among tasters is used and often preferred to statistical analysis
Reasons to use /not use sensory analysis for official control (open question)	The need of PDO food certification (legal exigency)	The need of PDO food certification (legal exigency). Quality issue	-
Other observations	Some certification bodies complain that there are not enough accredited laboratories available	High cost of the sensory analysis	-

565

566 **Fig. 1.** Decision tree for scoring appearance, odour, texture and flavour parameters in
 567 the sensory control of PDO Idiazabal cheese. ^a AC: appropriate characteristics. ^b NEAC:
 568 not entirely appropriate characteristic.
 569



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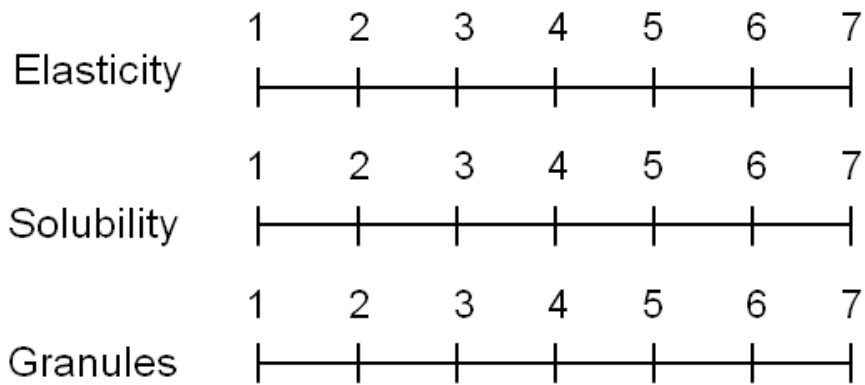
576 **Fig. 2.** Part of the Sensory scorecard for attributes of appearance and texture of TSG
577 Serrano ham (scorecard for appearance and texture attributes is not shown). Here some
578 attributes of appearance and texture are shown.

							Comments
lean meat colour	1	2	3	4	5	6	
colour homogeneity	1	2	3	4	5	6	
shiny appearance of fat	1	2	3	4	5	6	
pastiness	1	2	3	4	5	6	
softening	1	2	3	4	5	6	

579
580

581 **Fig. 3.** Part of the Sensory scorecard for Parmigiano-Reggiano cheese (texture
582 modality). The scorecard is divided into four modalities: appearance, smell, taste and
583 texture. Each modality has specific quantitative descriptors and a score for compliance
584 score with the pre-established sensory features of the Parmigiano-Reggiano. Here the
585 texture modality is shown
586
587

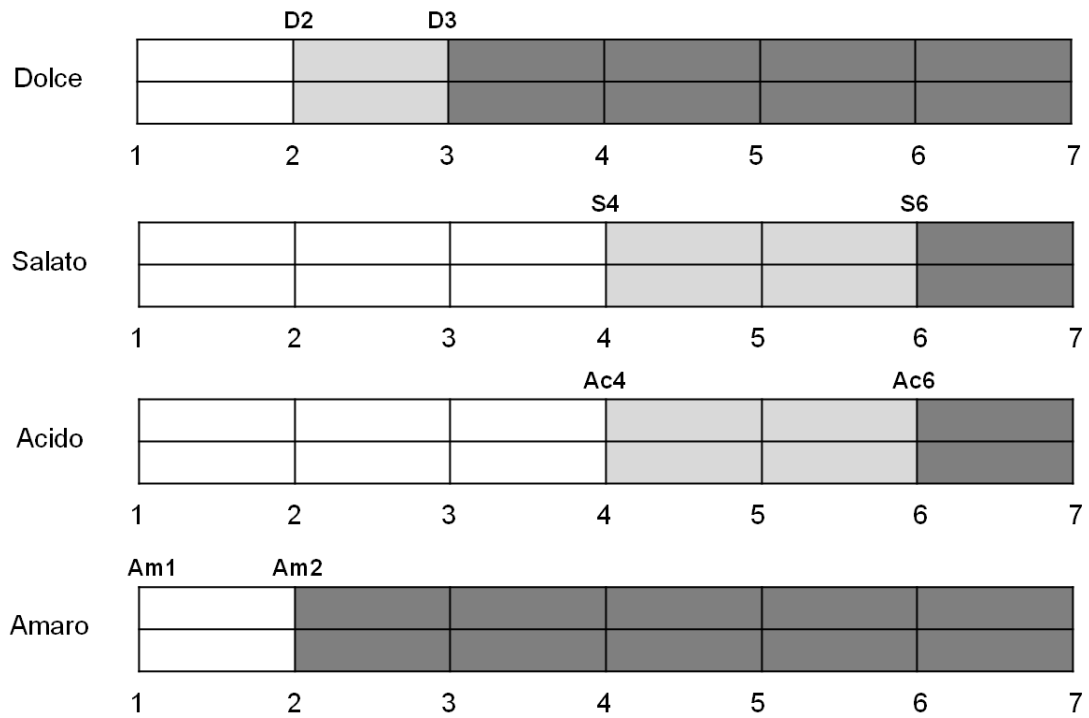
TEXTURE



Compliance score:

588
589

590 **Fig. 4.** Taste section of the sensory scorecard for the Asiago cheese (taste section).
 591 Every descriptor has a range of acceptability (green), a range of minor deviation from
 592 the accepted values (yellow) and a range on non-conformity (red).
 593




594
 595
 596

597 **Fig. 5.** Sensory scorecard for the Coteaux du Layon wine (aroma parameter). The
 598 scorecard is divided into four modalities: appearance, smell, taste and balance. Every
 599 modality has specific quantitative descriptors and compliance level are defined (framed
 600 accepted values; framed and in grey potentially eliminatory values).
 601

MOUTH						
Aroma intensity	0	1	2	3	4	5
Mouthcoating	0	1	2	3	4	5
Overripened	0	1	2	3	4	5
Mushroom	0	1	2	3	4	5
SO ₂	0	1	2	3	4	5
Volatile	0	1	2	3	4	5
Vegetal	0	1	2	3	4	5
Oxidation	0	1	2	3	4	5
Other defects	0	1	2	3	4	5
Defect type:					
Final balance	0	1	2	3	4	5

602
 603

604 **Fig. 6.** Sensory scorecard for Honey from Corsica. Taster give two quantitative notes
 605 (quality and percentage of matching with the varietal category).
 606

Characterization and notation scoresheet					Table n°															
 <p>ODG From « Miel de Corse – Mele di Corsica » PDO</p> <p>Product Agreement</p>					Date of tasting session: Firstname : _____ Surname : _____ College <input type="checkbox"/> Apiculturist <input type="checkbox"/> Technician <input type="checkbox"/> Consumers Signature : _____															
					Evaluation Recommendation <table border="0"> <tr> <td>Honey (Note A)</td> <td>Match with the type of product (Note B)</td> </tr> <tr> <td>1. Very good</td> <td>1. 100 % Match</td> </tr> <tr> <td>2. Good</td> <td>2. 75 % Match</td> </tr> <tr> <td>3. Correct</td> <td>3. 60 % Match</td> </tr> <tr> <td>4. Medium</td> <td>4. 50 % Match</td> </tr> <tr> <td>5. Mediocre</td> <td>5. 30 % Match</td> </tr> <tr> <td>6. Bad</td> <td>6. 15 % Match</td> </tr> <tr> <td>7. Very Bad</td> <td>7. 0 % Match</td> </tr> </table> <p>Honey with 1 to 4 are accepted Honey with 5 to 7 are not accepted</p>					Honey (Note A)	Match with the type of product (Note B)	1. Very good	1. 100 % Match	2. Good	2. 75 % Match	3. Correct	3. 60 % Match	4. Medium	4. 50 % Match	5. Mediocre
Honey (Note A)	Match with the type of product (Note B)																			
1. Very good	1. 100 % Match																			
2. Good	2. 75 % Match																			
3. Correct	3. 60 % Match																			
4. Medium	4. 50 % Match																			
5. Mediocre	5. 30 % Match																			
6. Bad	6. 15 % Match																			
7. Very Bad	7. 0 % Match																			
Type of honey P. Honey Spring MP. Maquis Honey Spring MM. Honeydew maquis ME. Maquis Honey Summer MA. Maquis fall C. Chataigneraie G. Corsica Honey																				
Tasting Comments					Notation															
Number	Visual (Appearance, Color)	Olfactory (Intensity, Quality)	Gustatory (Intensity, Quality, Taste, Duration, Off Flavor)	Texture in mouth (Viscosity, crystal quality)	Note A	Synthesis of the comments (Harmony, Typicity, Defects)	Type of Honey Named	Note B	Type of Honey Proposed											

607
 608