# Representations of pesticides and social practices: the case of French farmers

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**Abstract** Pesticides and their use in agriculture are important social issues. We conducted research to study the construction of this sensitive social object through the lens of social representations (study of the structural organisation of the social representations of pesticides) and their anchoring in three contexts that differ in terms of farming practices (Martinique, Brittany and Southern France). Our research was composed of two phases: hierarchical associations ($n$=213) and a context independence test questionnaire ($n$=124), conducted among farmers from the three study sites. The results indicate three representational fields that reflect salient issues in each agricultural territory. These illustrate the heuristic nature of social representations in the analysis of agricultural practices and pesticide use among French farmers.

**Keywords** Social representation · Environmental and social psychology · Pesticide

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## The use of phytosanitary products in France: from question to query

With 29 million ha of agricultural land and a turnover of 96 billion euros from agricultural production, France is the leading agricultural country in the European Union. This leading role correlates to significant use of phytosanitary products (PP), which are essential for maximum yields. In relation to an on-going desire to increase farmers' income, these yields are PPs' reason to exist (Desbois and Legris 2003). Therefore, the initial causes of the rampant use of PPs should first be analysed in terms of "economic reasons" (Barbichon 1968). Today, the productivist agriculture inherited from such practices is in "crisis" (Déléage 2005) and often stigmatised (Roussary et al. 2013). Indeed, it raises issues in terms of environmental (air, water and soil pollution), sanitary (public health) and professional (Dubuisson-Quellier 2009; Barrey and Kessous 2011) risks. The main aim of the *Ecophyto* plan, which was the starting point of our research, is to "reduce farmers' dependency on phytosanitary products while maintaining maximum yields, in quality and quantity" (Roussary et al. 2013, p. 68). This cannot be achieved without involving users of PP in the process of change. Hence, this study focuses on identifying such processes and obstacles of behaviour change. In order to achieve a targeted communication with PP users and conceive innovative changes in practice, we must identify PP users' social representations of pesticides and the role they play in agricultural practices. Considering these issues from the perspective of the social sciences is an undeniable opening (Nichter 2008).

## The pertinence of social representation theory

This study is original in that it seeks to integrate farmers as agents for change and hence no longer considers them only as spectators. This requires that we rely on "a community of practices that has shaped both ways of doing through multiple exchanges, and the concept of labour organised by a common pool of stories, challenges and experiences, gests, words and symbols" (Wenger 1999, p.27). Works by Nicourt and Girault (2011) should be noted, as they demonstrate the importance of involving winegrowers in change, and especially "attest to the benefits of endogenous collective action (...), appropriable mainly because it defines objectives on the basis of peer-to-peer dialogue" (Nicourt and Girault 2011, p. 23). Therefore, instead of imposing injunctions whose consequences are contrary to the desired results, it is necessary to capture information and knowledge amongst the farmers themselves by studying their social representation (SR) of pesticides. Social representations are defined as a type of social knowledge or "common sense" that is produced by "naïve" individuals, as opposed to "scientific knowledge" that is produced through logic (Moscovici 1961, p.54). Thus, social representations can be qualified as forms of collectively produced knowledge, which "contribute to the processes that guide behaviour" (Moscovici 1961, p.54). Better understanding of the social representations of pesticides among farmers will hence allow us to identify elements upon which to base a durable change in practice (Michel-Guillou and Weiss 2007). As such, recent theoretical developments have highlighted the role played by social representations in commitment and commitment communication. Indeed, several studies (Joule et al. 2007; Joule and Beauvois 2014) show that activating a central element of a social representation through a commitment act leads to more significant behaviour change than activating a peripheral element. In other words, knowledge about the structure of the social representation of an object allows improving the efficiency of commitment procedures and hence behaviour change (Souchet and Girandola 2013).

In return, collective practices participate in structuring a group's SR (Flament 1987, 2001; Guimelli 1993; Guimelli et al. 1999). Consequently, the expected change in practice, which is a reduction of PP use, will necessarily impact the evolution of the SR of pesticides. Furthermore, it is through different practices that groups distinguish themselves with regard to the same object. Such otherness marks the identity of groups. Thus, for an individual to engage in one practice rather than another (adoption of biocontrol solutions, for example), it has to be coherent with his/her group's values and norms: "it's not enough for an individual to be engaged in a practice for him/her to recognise it as his/her own and appropriate it. It also has to appear compatible with his/her value system" (Abric 1994, p. 220). This circular relationship between representations and practices clearly demonstrates the importance of apprehending representations both to better understand the associated behaviours that interest us and to better grasp the conditions of a possible evolution integrating norm and value systems that belong to the groups involved. Central core theory seems to provide a pertinent framework to grasp the dynamics between social representations and social practices.

Initially, the structural approach to social representations hypothesised that they are each composed of central elements surrounded by other peripheral elements. Hence, to understand the operation and meaning of a social representation, one must determine not only its content but also its structure, that is to say, the (central or peripheral) status of the elements it contains. Here, a social representation is considered as a system containing two complementary components: a central system and a peripheral system. Each set of central or peripheral elements has a particular function within the representation. The peripheral system has a function of embodiment, regulation and protection, and the central system, a function of organisation and stabilisation. As such, structure necessarily means hierarchy. Indeed, the integration of the central system within the broader peripheral system implies not only inclusion characteristics but also hierarchy. In other terms, individuals can attach different weights to each of the cognitions that make up their representation. Regarding the central core, we can list its functions, dimensions and its collective aspects. Indeed, it is "composed of one or more elements that give a representation its meaning", and hence determines its organisation (Abric 1994, p. 19). Abric (1994) specifies that the central core is "the most stable element of a representation, and that it ensures its sustainability in moving and evolving contexts" (*ibid.*, p.22). Flament (2001, p. 60) commented on the intrinsic link of the central core to the peripheral system, the former giving meaning to the latter; "it is a system in which the central core is a structure in charge of the organisation of the rest of the system, that is to say the peripheral elements". The central system is hence considered as a shared space for the group's memory: it is the product of historical, symbolic and social determinisms that a social group is submitted to (Moliner 1996, p. 61). Furthermore, a social representation is also composed of different elements that do not always have the same worth or the same suitability regarding the social norms that govern our society. Therefore, the "masking" of these elements can be qualified as "denial", and refers to the existence of a "mute zone" of the representation (Guimelli 2003).

## Methodology

### Sites of study

This research compares the SRs of farmers in three distinct agricultural territories: Brittany, Martinique and Southern France (the latter referring to the West of the PACA region and East of the Languedoc-Roussillon). In not only geo-climatic but also cultural terms, these territories correspond to contrasted regions in France,

with different histories and agricultural practices. Indeed, different crops justify different choices, especially in terms of PP use. The specific location of territories overseas could highlight aspects linked to cultural differences in the apprehension of pesticide issues. However, Martinique was also chosen to deal with a particular situation to do with Chlordecone, an organochlorinated insecticide used by banana growers for many years. In 2004, the risks related to the use of this pesticide were included in the National Health and Environment Plan (NHEP, action no. 12) and followed in Martinique by the Regional Phytosanitary Group (GREPHY). After having treated drinking water sources and organised preventive actions against the contamination of vegetables, the authorities wanted to structure their preventive action within the Chlordecone Plan. Thus, the environmental, sanitary and social consequences of Chlordecone use were the object of several works: scientific reports, epidemiological studies, reports by health agencies, new norms, and public prevention and evaluation (INSERM 2009). However, these studies focused mainly on aspects of the sanitary crisis caused by the use of this pesticide and on the health of individuals directly affected by it compared to the general population of the island (increasing risks of diabetes, cancer, myeloma, infertility, deformity, Alzheimer's, Parkinson's, etc.). Furthermore, data on this PP remain underexplored outside of biological and chemical spheres. Thus, Martinique, which mainly grows bananas, is particularly marked by the Chlordecone scandal, which people still keep in mind.

The humid climate in Brittany complicates any cultures without the use of fungicides. Indeed, farming in this region is characterised by intensifying the production of livestock, fodder and vegetables. This preponderance of agriculture is linked to fragmented agricultural plots, which facilitate the transfer of pesticides to watercourses.

On the contrary, Southern France is the region with the most organic farms. Thanks to cultures of grapevines, fruits and vegetables, Provencal agriculture is based mainly on plant products. Particularly in the PACA region, we find an important proportion of farmers engaged in organic or reasoned practices; at the end of 2010, the PACA region was the leading French region in terms of organic farming. Thus, behind the term "agricultural territories", we assemble these elements both according to the region and the territorial specificities in terms of agricultural practices. These three territories were indeed chosen because of their local specificities regarding farming practices and hence pesticide use. Thus, the link between practices and representations can be put to the test.

**Tools phase 1: hierarchical associations questionnaire**

*Aims of phase 1*

The aim of this first stage of research was to identify the contents of the social representation of pesticides among French farmers. The hierarchical associations questionnaire allows making assumptions about the structure of the social representation of the studied object.

*Participants*

We questioned a sample of 213 French farmers: 25 females and 188 males ($M$=40.43; SD=1.86). Sample details per territory are presented in Table 1.

*Procedure and data processing*

To access the social representation of pesticides, we used a hierarchical associations questionnaire (Abric 1994; Moliner et al. 2002; Lo Monaco et al. 2008). Directly inspired by works by Vergès (1992, 1994), this method is pertinent in that it allows "the updating of implicit or latent elements that would be overcome or masked in discursive productions" (Abric 2001, p.63). It consists in asking each farmer to associate to the term "pesticide" the first five words or expressions that he/she spontaneously thinks of. Participants must then arrange their associations from (1) the least important to (5) the most important. Thus, each item associated to the inductor pesticide benefits from an average value of importance in the representational field, as well as a mean frequency. Both of these indicators allow us to hypothesise (Abric 2001) about the status of the elements (i.e. central vs. peripheral): Potentially, central elements are both most frequent and most important. In addition, some objects are "sensitive" in that it is difficult to talk about them spontaneously: When an individual is asked to express his/herself about a social object, the listed elements can vary contextually (Guimelli and Deschamps 2000). Elsewhere, it has been shown (Weiss et al. 2006) that farmers do not easily talk about certain aspects of their profession from fear of being judged negatively. Thus, when questioned about the environment, they do not spontaneously mention issues of pollution, which can be associated to a stigmatisation of agricultural practices. Moreover, they refuse any responsibility regarding their practices by operating self-serving social comparisons (Weiss et al. 2006). Here, we hypothesise that pesticides are such *sensitive* objects in that it is difficult to talk about them as a user. Indeed, they are socially stigmatised objects because they are associated to not only sanitary but also environmental risks, and nowadays, social norms favour the "environmentally friendly". In order to highlight these difficult-to-express elements, and hence potentially "masked" elements, "self-other substitution" allows individuals to express themselves in the name of a larger group: here, "farmers in general". The aim of self-other substitution is to "place the participant in a context that is distant from his/her reference group, and hence enable him/her to express his/her thoughts more freely by reducing any risks of negative judgment by others" (Abric 2005, p. 15), thereby revealing the mute zone of the social representation. Therefore, we questioned farmers either in a "standard" or a "substitutive" context in order to obtain a broad nomenclature of the social representation of

Table 1 Sample of farmers questioned in phase 1 of the study "Hierarchical associations"

| | Organic farming | Conventional farming | Reasoned farming | Total |
|---|---|---|---|---|
| Southern France | 30 | 6 | 14 | 50 |
| Brittany | 10 | 92 | 25 | 127 |
| Martinique | 5 | 29 | 2 | 36 |

pesticides in our samples. The collected corpus was first lemmatised and hapaxes[1] were removed. Following this initial "cleaning", we used the software *Evoc 2000* to conduct lexicographical analysis on answers to the questionnaire. The main advantage of this software is its ability to highlight two criteria (i.e. frequency and rank) and hence hypothesise about the status of each element. The hierarchical association technique only allows hypothesising about centrality. In the second phase, we conducted a context independence test (CIT) to validate or invalidate these centrality hypotheses.

### Tools phase 2: context independence test

*Aims of phase 2*

The aim of this second phase was to validate the centrality hypotheses highlighted in phase 1 of this research. In other words, following the results obtained with the hierarchical association questionnaire, we administered a context independence questionnaire to a different sample in order to confirm the structure of the social representation of pesticides.

*Participants*

We questioned a sample of 124 French farmers: 20 females and 104 males ($M$=40,43; SD=1.83). Sample details per territory are presented in Table 2.

*Procedure and data processing*

This test (CIT; Lo Monaco et al. 2008) determines the structural status (central vs. peripheral) of the elements that constitute a representation and hence account for their respective importance.

The CIT is presented as a list of questions that focus on the independent or dependent characteristics of the studied items. For example, "in your opinion, are pesticides always and in every case a sanitary risk?" Subjects answer the question on a scale from 1 to 4 (*no*, *not really*, *generally yes*, *yes*; for statistical analysis, "no" and "not really" scores were combined, as were "generally yes" and "yes" scores). The phrasing "always and in every case" operationalises the idea of context independence. Thus, an affirmative answer means that, in the eyes of the subject, the relevant element is valid in all circumstances and constitutes a central element of the corresponding social representation. Once all answers were collected, we counted the number of positive answers per item and then expressed these occurrences as percentages. Furthermore, we also calculated a $D_{max}$ index for an error probability of .05 following Kolmogorov-Smirnov's law as advised by Abric (2001). Calculating this index sets the threshold from which an element can be considered central with respect to its percentage of occurrence.

## Hypotheses

Given the highly social nature of the studied object (i.e. pesticides), mainly due to discourse and debates aroused by the media, we hypothesise that the social object pesticides possesses all the necessary characteristics to be the object of a structured social representation. Moreover, given the role played by social practice and the environment in the structure of a social representation, we hypothesise that the structure will differ between the studied agricultural territories.

## Results

### Centrality hypotheses

A total of 1065 associations were collected. Tables 3, 4 and 6, present the elements that constitute the social representations of pesticides for each study site (i.e. Brittany, Southern France and Martinique), obtained with the hierarchical association technique in two contexts (standard vs. substitution).

We present these associations according to the classification obtained with the software *Evoc 2000*, which offers four structural statuses underlying the social representation of pesticides according to rank and frequency:

- Potentially, central elements are both frequent and high-ranking,[2] that is to say, they are both mentioned and considered more important than the other elements.
- Potentially, peripheral elements are both infrequent and low-ranking, that is to say, they are mentioned less and considered less important than the other elements.
- The two other categories (contrasted elements and second periphery) correspond to elements whose frequency and

[1] A *hapax* is an answer with a frequency of 1.

[2] Rank does not correspond to order of appearance, but to the rank attributed to each word by the subjects.

Table 2 Sample of farmers questioned in phase 2 of the study "Context Independence Test"

| | Organic farming | Conventional farming | Reasoned farming | Total |
|---|---|---|---|---|
| Southern France | 20 | 10 | 11 | 41 |
| Brittany | 0 | 27 | 14 | 41 |
| Martinique | 4 | 16 | 22 | 42 |

Table 3 Classification of associations (Evoc 2000) for farmers in Southern France (frequency; rank)

| | Standard context | Substitutive context |
|---|---|---|
| Central elements | Protection equipment (f = 10; r = 3.10) | Danger (f = 11; r = 3.72) |
| | Yield (f = 7; r = 4.28) | |
| | Treatment (f = 8; r = 3.75) | |
| Peripheral elements | Treatment product (f = 20; r = 2.75) | Pollution (f = 11; r = 2.63) |
| | Environmental risks (f = 11; r = 2.75) | Treatment product (f = 13; r = 2.69) |
| | | Treatments (f = 12; r = 2.75) |
| Second periphery | Illnesses (f = 6; r = 2.83) | Agriculture (f = 3; r = 2.33) |
| | Pollution (f = 6; r = 2.83) | Struggle (f = 4; r = 2.00) |
| | | Protection (f = 6; r = 2.66) |
| | | Devastating (f = 3; r = 2.00) |
| Contrasted elements | Danger (f = 6; r = 3.00) | Need (f = 3; r = 3.66) |
| | Grow a crop (f = 5; r = 4.40) | Water (f = 3; r = 3.33) |
| | | Norms (f = 4; r = 3.50) |
| | | Sprayer (f = 4; r = 3.50) |
| | | Reasoned (f = 3; r = 3.66) |
| | | Yield (f = 3; r = 4.66) |
| | | Sanitary risks (f = 6; r = 3.50) |
| | | Responsible use (f = 4; r = 3.75) |

rank are not congruent. They are either frequent or considered important, but not both at once. They will hence be tested in the same way as the central elements in the second phase, namely the CIT.

This Table 3 clearly shows the differences between self-other substitution and the standard context. Indeed, the standard context revealed no elements regarding risks in the central zone or first periphery. These appear in the second periphery (low frequency and importance), with the terms "pollution" and "illness", as well as biodiversity (bees) and other, more varied aspects. The notion of "danger" only appears as a contrasted element (low frequency and high importance).

On the contrary, the substitutive context revealed the term danger in the central zone. In fact, this was the only element in that zone. The first periphery supports this aspect, with the element pollution along with more technical aspects. Finally,

Table 4 Classification of associations (Evoc 2000) for farmers in Martinique

| | Standard context | Substitutive context |
|---|---|---|
| Central elements | Norms of use (f = 9; r = 3.77) | Norms of use (f = 9; r = 3.55) |
| Peripheral elements | Knowledge of use (f = 7; r = 2.85) | Grow a crop (f = 15; r = 2.66) |
| | Danger (f = 9; r = 2.62) | Environmental risks (f = 10; r = 2.40) |
| | Phytosanitary product (f = 13; r = 2.92) | Sanitary risks (f = 12; r = 2.16) |
| | Environmental risks (f = 13; r = 2.92) | |
| | Treatment (f = 11; r = 2.27) | |
| Second periphery | | Pollution (f = 7; r = 2.57) |
| | | Phytosanitary product (f = 7; r = 2.71) |
| Contrasted elements | Necessary (f = 5; r = 6.60) | Organic farming (f = 3; r = 4.66) |
| | Reduction (f = 2; r = 4.50) | Weedkiller (f = 2; r = 3.00) |
| | Sanitary risks (f = 4; r = 3.50) | Toxic (f = 7; r = 3.57) |

Table 5 Classification of associations (Evoc 2000) for farmers in Brittany

| | Standard context | Substitutive context |
|---|---|---|
| Central elements | Pollution (f = 31; r = 3.00)<br>Sanitary risks (f = 44; r = 3.11)<br>Harmful (f = 39; r = 3.42)<br>Treatment (f = 40; r = 2.97) | Danger (f = 10; r = 3.40)<br>Insecticide (f = 8; r = 3.00)<br>Stigmatisation (f = 8; r = 3.37)<br>Toxic (f = 16; r = 3.06)<br>Treatment (f = 12; r = 3.75)<br>Grow a crop (f = 10; r = 3.39) |
| Peripheral elements | Danger (f = 38; r = 2.86)<br>Environmental risks (f = 23; r = 2.73) | Weedkiller (f = 8; r = 2.75)<br>Pollution (f = 15; r = 2.60)<br>Environmental risks (f = 11; r = 2.72)<br>Price (f = 11; r = 1.33) |
| Second periphery | Chemical (f = 5; r = 2.00)<br>Right amount (f = 3; r = 2.33)<br>Knowledge of use (f = 7; r = 2.42)<br>Destruction of crops (f = 4; r = 2.50)<br>Pests (f = 4; r = 2.00)<br>Norms of use (f = 6; r = 2.50)<br>Price (f = 6; r = 1.33)<br>Phytosanitary product (f = 15; r = 2.64)<br>Profession (f = 4; r = 2.75)<br>Use protection (f = 17; r = 2.82)<br>Yield (f = 16; r = 2.75)<br>Stigmatisation (f = 9; r = 2.11) | Technical support (f = 2; r = 2.00)<br>Future (f = 2; r = 2.50)<br>Fungicide (f = 7; r = 2.00)<br>Norms of use (f = 5; r = 2.60)<br>Phytosanitary product (f = 6; r = 2.50)<br>Profession (f = 2; r = 2.00)<br>Yield (f = 5; r = 2.80)<br>Sanitary risks (f = 6; r = 2.16) |
| Contrasted elements | Bees (f = 2; r = 3.00)<br>Weedkiller (f = 8; r = 3.00)<br>Reduce (f = 4; r = 3.00)<br>Companies (f = 10; r = 2.90)<br>Fungicide (f = 4; r = 3.25)<br>Insecticides (f = 10; r = 3.40)<br>Healthy vegetables (f = 3; r = 4.66)<br>Harmful (f = 6; r = 3.33)<br>No alternative (f = 4; r = 3.75)<br>Protection of crops (f = 22; r = 3.09)<br>Sprayer (f = 4; r = 2.25) | Conventional agriculture (f = 2; r = 3.00)<br>Chemical (f = 2; r = 3.00)<br>Yield (f = 5; r = 2.80)<br>Culture (f = 4; r = 4.50)<br>Water (f = 2; r = 3.00)<br>No alternative (f = 7; r = 3.14)<br>Protection of crops (f = 7; r = 3.42)<br>Use protection (f = 3; r = 3.00)<br>Sprayer (f = 4; r = 3.25) |

both other zones are richer than in the standard context because elements regarding the profession, environmental aspects and the effective use of pesticides are more numerous.

Here, in the Table 4, the central element is the same no matter the context: norms of use. In the standard context, the first periphery contains items regarding the risks and level of knowledge in relation to pesticide use. The contrasted elements are more varied and span from the necessity to the reduction of pesticide use. In the substitutive context, the first periphery is close to that of the standard context, as it is also composed of items regarding the risks of pesticide use; however, it also contains a more definitional component ("grow a crop").

In the standard context (Table 5), the central zone contains negative elements. In Brittany, on the contrary, the notions of pollution, danger and risk are present. The central zone and first periphery contain items that mostly refer to the dangers of pesticides. The other zones are very rich. Indeed, the second periphery refers to elements directly linked to the profession and economic aspects (prices, yields), as well as to more technical aspects and consequences of use. The contrasted elements are more focused on environmental aspects, such as crops, biodiversity (bees) and other, more varied aspects. In the substitutive context, the term "stigmatisation of agriculture" appears in the central zone, along with aspects regarding the risks of pesticide use in the first periphery. Again, the second periphery refers to the profession and its future, as well as aspects to do with the use of pesticides.

All three tables confirm the relationship between agricultural territory and representation, which appears to be predominantly central. Thus, different practice-related representations emerge for each territory, hence distinguishing between the three groups studied. For example, the notions of "environmental risks" and danger only appear as potentially central elements expressed by Breton farmers, whereas those from Martinique or Southern France are more focused on norms of use for the former and on the conditions for phytosanitary treatments for the latter. However, the three representations also share some items, because all three subsamples belong to a larger group of farmers who differ in terms of the specificities of their agricultural practices.

In order to verify the effective centrality of the elements obtained in this initial phase, the results must be confirmed by a context independence test.

**Table 6** Comparison of $D_{max}$ to the rate of "yes" answers for the elements submitted to the CIT for the item "pesticides" among farmers in Southern France

| Associations | Rate of "yes" answers in % | Comparison with $D_{max}$=79.02 |
|---|---|---|
| Protective equipment | 100 | 100>79.02 |
| Environmental risks | 80.95 | 80.95>79.02 |
| Responsible use | 100 | 100>79.02 |
| Norms of use | 100 | 100>79.02 |

**Table 7** Comparison of $D_{max}$ with the rate of "yes" answers for the elements submitted to the CIT for the item "pesticides" among farmers in Martinique

| Associations | Rate of "yes" answers in % | Comparison with $D_{max}$=79.02 |
|---|---|---|
| Norms of use | 95.23 | 95.23>79.02 |
| Environmental risks | 88.09 | 88.09>79.02 |
| Sanitary risks | 83.33 | 83.33>79.02 |
| Toxic | 92.85 | 92.85>79.02 |

## Diagnostic of centrality

As a reminder, the substitution technique gives us access to items that do not appear in the standard context. That being said, we proceeded with a centrality diagnostic on the set of items with a CIT. In other words, for each region and each sample, we tested the potentially central and potentially peripheral items, as well as certain elements that appeared contrasted. To achieve this, we administered a CIT questionnaire to farmers from Brittany, Martinique and Southern France (Tables 6, 7 and 8).

Tables 6, 7 and 8 confirm that the social representations of pesticides differ between research sites, in the sense that the CIT validates the centrality of different elements for each territory. Given that these territories define different agricultural practices, these results also confirm a strong link between representations and practice. The CIT confirms the centrality of most of the potentially central elements from phase 1, revealing the same lexical fields in each sample. Furthermore, the element environmental risks appear central in all three representations.

## Discussion/conclusion

These results reveal an impact of the "agricultural territory" variable on the representation of pesticides. Therefore, they support our hypothesis that social practices related to pesticides are the key in the elaboration of social representations of pesticides. As noted by Abric (2001), a practical relationship, a high level of knowledge and being involved are all factors that reduce distance to an object. The practical relationship between farmers and pesticides enriches their knowledge about them. This demonstrates the importance of the peripheral elements of a social representation in guiding behaviour with regard to an object. Thus, this process echoes works by Flament (1994a) who considers social representations as organised systems of descriptive and prescriptive cognitions. According to the author, prescriptive cognitions refer to "procedural" knowledge.

Analysis of the results revealed three different representational structures between regions and hence three different social representations. Different "geo-cultural" anchors

**Table 8** Comparison of $D_{max}$ with the rate of "yes" answers for the elements submitted to the CIT for the item "pesticides" among farmers in Brittany

| Associations | Rate of "yes" answers in % | Comparison with $D_{max}$=78.76 |
|---|---|---|
| Sanitary risks | 95.12 | 95.12>78.76 |
| Environmental risks | 82.92 | 82.92>78.76 |
| Treatment product | 80.48 | 80.48>78.76 |
| Expensive | 82.92 | 82.92>78.76 |
| Yield | 87.8 | 87.8>78.76 |
| Stigmatisation | 90.24 | 90.24>78.76 |
| Harmful | 80.48 | 80.48>78.76 |

(Doise 1992, 2005) can explain these results. Thus, the object pesticides has different meanings for farmers depending on their place of residence and practice (Martinique, Brittany, Southern France). These cultural anchors, or social roots, explain different stances regarding the object. This "type of approach constitutes a fertile path for analysing correspondences between social contexts and modes of social thought in the forming of a representation" (Dos Santos et al. 2011, p. 390).

In Southern France, where the use of pesticides is low, we observed a normative dimension referring to "responsible" discourse about pesticide use. Based on this observation, the representation is made of elements such as protective equipment, norms of use and responsible use. This normative discourse also contains the item environmental risks. In other terms, the social representation of pesticides among farmers in Southern France is structured around central elements that refer to public authorities' discourse that is addressed to farmers, such as the idea that pesticides should be used responsibly with protective equipment, respecting the terms of use, and being aware of any environmental risks that pesticide use entails. This is a prescriptive function of social representations.

In Brittany, where pesticide use is high, we observed a representation structured around three dimensions: (1) risks and dangers related to pesticide use (including the items "sanitary risks", environmental risks and "harmful"), (2) the perception of farmers by the population and (3) an economic dimension. These three dimensions inform us about different aspects of the social representation of pesticides in the Breton territory. As a structuring element of the representation, the item "stigmatisation" helps to understand the anchoring of the social group "farmers" in the general population. Breton farmers are indeed often pointed at when it comes to soil and water pollution (Hellier et al. 2013; Michel-Guillou 2011). This is another function of social representations, that is to say, the social expression of unhappiness (Jodelet 1989). The dimensions referring to (sanitary and environmental) risks indicate that Breton farmers have integrated the adverse consequences of pesticides into their social representation. The economic dimension is also fairly structuring in this sample: The item "treatment product" should be considered as an echo of the term "expensive". In other words, the economic aspect of pesticides strongly contributes to structuring the social representation.

Lastly, in Martinique, where pesticide use is high, we observed a social representation structured around two dimensions: (1) risks and dangers related to pesticides and (2) the regulatory aspects of their use. It is as if knowledge about the risks is diminished by knowledge about the norms of use of phytosanitary products. Both dimensions are without doubt the result of policies in the wake of the Chlordecone-polluted soil scandal in Martinique. This pesticide is particularly long lasting in the soil and as such, governmental plans aim to put in place the necessary measures to accompany farmers whilst also reinforcing local communication to reassure farmers and consumers. Because of this, farmers are highly monitored and have to follow training courses, particularly on the use of phytosanitary products. Furthermore, most respondents in the study work for small and medium farms that have been importantly changed over the last 20 years: They are more and more modern and professional and often offer diversified crops (livestock, vegetables, arboriculture, etc.). Indeed, Martinique seems more focused on a productivist view. This observation can be explained by farmers' desire to reduce their economic vulnerability and their insular dependency, given that "useful spaces" for crops is limited and the economic context largely depends on the stock market and funding (Magnan 2009). Consequently, diversifying crops reduces these dependencies and favours a greater ability to adapt. This need to produce more hence explains the regular use of phytosanitary products. Keeping informed about the risks and regulations about pesticide use reassures farmers and allows them to adapt to economic constraints and geographic specificities, as well as develop local resources, which are perceived as a source of community identity (Fomoa-Adenet and Rieutort 2008).

Therefore, the study of social representations should avoid a simple description of different representational structures so as not to fall, "as is often the case in terms of social representations, between triviality and originality" (Moliner et al. 2002, p. 202). Nonetheless, numerous clues for interpretation can be found in issues raised by the farmers' social context. Thus, farmers in Southern France do not include any dimensions regarding sanitary risks in their central elements (nor in their peripheral elements), as opposed to both other groups of farmers. This result is even more consistent when considered along with the other items that structure the representation. Indeed, given that farmers in Southern France represent pesticides in terms of norms of use (cf. items regarding norms of use, responsible use, protective equipment), they logically and coherently do not integrate any items in terms of sanitary risks. The group of farmers in Southern France hence differs from Breton and Martinique farmers, who express common dimensions regarding pesticides. In particular, we observed the item sanitary risks in both representational fields. Martinique has known important sanitary issues with regard to Chlordecone use. We suppose that the island's history in relation to this sanitary scandal has impacted the creation of the social representation of pesticides among Martinique farmers. The item sanitary risks is also present in the Breton context. These farmers also use pesticides. They differ from Martinique because of their negative image, because no items in terms of protection or norms of use appear in the Breton representational fields, neither in the central elements, nor in the peripheral elements.

The representational structure highlighted in this study seems to reveal a social state regarding pesticide issues in

three different contexts. These results illustrate the contribution of social representation theory to the study of pesticides as a socially constructed object, as a *total social fact* (Mauss 1973), or, as stated by Gauthier (2010), as a "controversial" object combining enough characteristics to evolve public discourse and, *a fortiori*, to be an object of representation. Within a context or culture, social representations allow the study of the interpretations of an object through "the enrolment of subjects in a social order and history" (Jodelet 2002, p. 129).

From a practical point of view, this social representation analysis captures some of the issues related to pesticide use: Although the question of environmental risks is present in all three samples, it is not the case of sanitary risks, which calls into question pesticide use and precautions to be taken. Furthermore, the discourse focuses on different elements: norms of use in one case (Southern France), toxicity in the second (Martinique) and more general issues in terms of agricultural practices in the third (Brittany). These different anchors highlight specific preoccupations among farmers regarding their practice and use of pesticides. These aspects should be explored more precisely but already provide clues about the possibilities of better involving farmers in a more general discussion about changes in practice, and at the same time integrating these important aspects in the practice of their profession. Furthermore, considering social representations of pesticides from the point of view of lay thinking can account for a social reality that induces a rehabilitation of common sense (Nichter 2008). In other words, "this approach rehabilitates social thought to consider it differently than just a gap between scientific and secular knowledge" (Caillaud et al. 2010, p. 626). Furthermore, as stated by Jusunio, "the astounding progress of science does not however reduce the sphere of common sense. On the contrary, the inevitable taylorization of scientific work leads to a reinforcement of both forms of knowledge we are all scientists just as we are all laypersons. This is presumably the situation that Jesuino had in mind when he stated that we have entered the era of social representations" (2008, p. 394). Therefore, it is essential, when communicating about the risks of pesticide use, and more generally about the necessity to significantly reduce their use, to consider the "social system to prevent or adapt to crisis situations" (Specht 2008, p.46). Finally, the study of the social representations of pesticides amounts to the consideration of "socially shared worlds of interpretations in which objects are appropriated and legitimised in individual or social behaviours" (Dos Santos et al. 2011, p. 375).

**Conflict of interest** The authors declare that they have no conflict of interest.

**Funding** This project is supported by the research program "Assessing and reducing environmental risks from plant protection products" funded by the French Ministry in charge of Ecology and Agriculture.

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