Evaluation of different instruments for signalling the reduction of pesticides, survey of the literature about the role of extrinsic cues which include the pesticide reduction in their production requirements for improving the WTP

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Deliverable Factsheet

Date: December 2009

Deliverable	4.3 : Evaluation of different instruments for signalling the reduction of pesticides, survey of the literature about the role of extrinsic cues which include the pesticide reduction in their production requirements (brands, label "Bio", certification of origin, etc.) for improving the WTP
Working Package	WP4 : Indirect Pesticides Costs on Consumers Willingness to Pay
Partner responsible	INRA
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Dissemination level	PU
Delivery date according to DoW	October 2009
Actual delivery date	December 2009
Finalization date	November 2010
Relevant Task(s):	4.3

Brief description of the deliverable:

This deliverable presented a literature review about the role of extrinsic cues for the pesticide reduction. The results of one experimental market focused on consumers' willingness to pay for apples with different labels (public and private labels) that signalling the reduction of pesticides were presented.

Followed methodology / framework applied:

Economic experimental method: Becker-DeGroot-Marschak procedure and choices between different size lots of the preferred apple and any other apples.

Target group(s):

Experimental economics research units

Key findings / results:

We showed that the most valuated cues for pesticide reduction is organic label. In Portugal, the premium for organic is 96.4% and for France is 72.5%. IPM certifications have also a high premium. However, producer's guarantee is more credible than retailer's. Moreover, we noted that sensory information may have a strong impact which should not be overlooked.

Interactions with other WPs deliverables / joint outputs

WP no.	Relevant tasks	Partner(s) involved	Context of interaction
5	5.2	WU and LEI	Product choice (apple) and experimental auction for Netherlands (in 2010)

Project no. **212120**

Project acronym: **TEAMPEST**

Project title:
Theoretical Developments and Empirical Measurement of the External Costs of Pesticides

Collaborative Project

SEVENTH FRAMEWORK PROGRAMME
THEME 2
Food, Agriculture and Fisheries, and Biotechnology

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Deliverable 4.3

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December, 15th, 2009

Extended summary

The main objective of the work package 4 is to examine the impact of pesticides reduction from a consumer point of view. Consumers' willingness to pay (WTP) for the reduced use of pesticides in the production of fresh and processed foods, are measured. In addition, this work package analyses the efficient way to disseminate the information on pesticides reduction to consumers (brands, signals of quality, different labels, etc.). Experimental markets are carried out in Portugal, France (for the period May 2008 to October 2009) and then in Greece and Holland (2010).

The literature shows that exist segments of the population willing to pay more for the products that present a label identifying specific credence attributes. Labels signalling a country-of-origin (PGI, PDO, CSC), a production system (organic, IPM, eco-labels) or fair trade have been studied to know if they are a very important mean to convey information to consumers. Specifically, the eco-labels have been analyzed and compared to others labels (mandatory labels, organic labels) to understand if they are the right way to encourage both producers and consumers to make environmental improvements.

To evaluate the different instruments for signalling the reduction of pesticides, we used an experimental market and we determined consumer's willingness to pay (WTP) for produce grown with different pesticide levels. For our experimental markets conducted in Portugal (February, 2009) and France (May, 2009), consumers' WTP were estimate using the apple example, for three levels of pesticide reduction: i) "Regular": apples produced in the respect of the legal legislation. These apples don't have any cue. ii) Integrated Pest Management (IPM): apples produced with a decrease of the pesticides' use. In our experimental markets, IPM strategy involved three different signals with a "generic" IPM certification, a retailer brand and a protected designation of origin, (iii) "Organic": apples produced without any synthesis pesticides.

We show that there is a consumer WTP for pesticides use reduction (a premium for product with specific signal) and that a specific information on pesticide use increases this WTP for organic product but not for IPM product. However, the most important result is that the specific information decreases the WTP for the regular product. Then it seems more rigorous to treat the results in terms of "premium against the regular product", anticipating the loss of market share for the regular product.

Furthermore, we showed that the most valuated cues for pesticide reduction is organic label. In Portugal, the premium for organic is 96.4% and for France is 72.5%. IPM certifications have also a high premium. However, producer's guarantee is more credible than retailer's. After showing that consumers' premium for pesticide reduction is not independent from the product's sensory attributes, we give the quantitative results for the consumers WTP for a pesticide reduction. In addition the estimation of demand elasticities can provide essential results for other WP within TEAMPEST.

For the socio economic impact of our research, we explain why consumer's awareness of food safety and social preferences for improving the environmental sustainability of agriculture has led to the design and application of new policy instruments such as eco-labelling of fresh produce. However, the availability of detailed and disaggregated monetary estimates of individuals' WTP for pesticide risk seem to be crucial to implement such policies successfully. Indeed, WTP information provides a basis for price differentiation according to the type and severity of pesticides risks involved in production. Moreover, environmental voluntary agreements (VAs) between regulators and polluters are becoming an increasingly relevant environmental policy instrument, thanks to their flexibility and consensual character. These agreements can assume a wide variety of forms and aims. Efficiency conditions and effectiveness in their use depend crucially on the environmental WTP (producers adhere more easily to the VAs if the WTP is high).

Table of Content

1. Introduction

Survey of the literature about the role of extrinsic cues which include the pesticide reduction in their production requirements for improving the WTP

Extrinsic cues, such as brand, store name, price, certification and labels, interfere with both the consumers' perceived quality and perceived risk as they are attached to an array of characteristics that must be processed and understood by the consumers at the moment of purchase. Thus, the ways companies and/or governments use to provide information to consumers are crucial for helping them in their choices. For Miyazaki *et al.* (2005) they must all present consistent information in order to be significantly predictive of the product's quality. What is the consumers' reaction to all this different extrinsic cues provided to them? Do they read this cues properly and act accordingly? Is there a best cue to signal, for instance, a pesticide reduction?

Labelling appears as a well-known procedure to convey information as any consumer comes across multiple examples in his routine purchases.

A label can perform multiple roles - an instrument that reduces the asymmetric information between producers and consumers (Loureiro and McCluskey, 2000); a risk-reduction strategy (Aqueveque, 2006; Kim, 2008) or an input to perceived risk assessment (Conchar *et al*., 2004); an extrinsic quality indicator (Caswell *et al*., 2002); they can even be thought of as acting as both 'windows' and 'mirrors' - they mirror by giving consumers access to information about how a product was produced and they also reflect the aspirations and concerns of the purchaser and their peer group (Zadek *et al*. 1998). They are, as Caswell and Padberg (1992) advocate, much more than consumers' "point-of-purchase" information. For these authors labels can play several third-party roles – a significant product-design influence; a public surveillance assurance; a public values definition; a nutrition and food safety education format.

Labels signalling a country-of-origin (PGI, PDO, CSC), a production system (organic, IPM, eco-labels) or fair trade are a very important mean to convey information to consumers since they deal mainly with credence attributes[1]. For these the consumer has to rely on trust in the information provided (Kim, 2008).

[1] Darbi and Karni (1973) defined the concept of credence attributes – the ones that can not be assessed even after purchase and consumption. For instance pesticide residues, nutritional value, organic production. These authors

As Grolleau and Caswell (2002) point out search and experience attributes can be cheaper and easier indicators of credence attributes – because, for example, safety output may be too costly to measure (e.g. the absence of pesticides residues), it may be more cost effective to measure management practices (e.g. organic farming) instead of the final product characteristics. Already Noelke and Caswell, in 2000, developed a model of quality assurance for credence attributes that highlighted the practice of companies to employ extrinsic indicators and cues to transform intrinsic credence attributes into extrinsic search indicators (Caswell *et al*. 2002). In fact consumers will use the cues readily available to them such as eco-seals of approval, logos of well-known environmental associations, price and brand name (Grolleau and Caswell, 2002).

One can find numerous studies dealing with consumers' preferences and WTP for various credence attributes associated with the processes used to produce foods and, even though the results vary, the general consensus has been that exist segments of the population willing to pay more for the products that present a label identifying specific credence attributes (Umberger *et al*., 2003). It is the case of Loureiro *et al.* (2001) when assessing, through a survey data and contingent valuation, Oregon's (USA) consumers' preferences for organic, eco-labeled, and regular apples – eco-labeled apples were found less desirable than organic when food safety, the environment and childrens' needs were considered; of Rozan *et al.* (2004) when performing, on French consumers, an experimental investigation of quality certification on bidding behaviour for apples, potatoes and bread, using either a second price auction or the BDM procedure – the buying prices for non-certified products (regarding heavy metal concentration) decreased when such information was released; of Lusk and Fox (2002) when analysing, using a contingent valuation mail survey, the United States consumer demand for mandatory labelling of Beef from cattle administered growth hormones or fed genetically modified corn – 85% of respondents desired mandatory labelling of beef produced with growth hormones and 64% preferred mandatory labelling of beef fed genetically modified corn; consumers would be willing to pay 17.0 percent and 10.6 percent higher prices for beef on average to obtain information provided via mandatory labelling about whether the beef is from cattle produced with growth hormones or fed genetically modified corn, respectively; of Bond *et al.* (2008) when studying in the USA, using factor and cluster

added to the work of Stigler (1961, 1962) and Nelson (1970) responsible for the first works that dealt with the categorization of the information provided to the consumer. The first named as search attributes those characteristics a consumer can verify just by looking at the product. The latter went further introducing those characteristics that can only be evaluated after the product's consumption.

analysis, the choices several consumers' segments make about fresh produce and what they are willing to pay for several process-based attributes - organic and alternative production systems are important differentiation factors, but as the cluster analysis indicates, customers are primarily motivated by a number of private attributes not necessarily related to organic production, although importance of attributes is somewhat heterogeneous across groups. In fact, local production appears to be more valued than organic production, and the pesticide-free attribute ranks highly for at least three clusters; of Bougherara and Combris (2009) when investigating, through the BDM procedure, whether the premium french consumers (Dijon region) were willing to pay for an eco-labeled bottled orange juice, was driven by selfish or altruistic motives – the WTP a premium for an eco-label appears to be motivated by the desire to contribute to a public good for purely altruistic reasons, or selfish motives other than food taste or safety; of Loureiro and McCluskey (2000) when assessed spanish consumers' response to a PGI label (Galician veal) using the hedonic price technique - they concluded that if the label is present on high quality cuts of meat, one can obtain a premium up to a certain level of quality and suggested that the PGI can be an effective signal of quality only when in combination with other indicators or signals of quality (price, place of purchase).

The Ecolabels, present for the past ten years in industries such as agriculture, fisheries, forestry and energy, are a way to incentivate both producers and consumers to make environmental improvements. An eco-label credibility relies completely on the consumers trust, being an extrinsic cue that signals exclusively credence attributes. But the consumers trust in them can be affected by several other aspects such as the search and experience attributes of the labeled products (Grolleau and Caswell, 2002). The authors state that consumers form expectations about the levels of search (e.g. less packaging) and experience attributes (e.g. better taste) based on the presence of an ecolabel and their subsequent evaluation of these attributes will influence the credibility of the environmental claim and their interest in repeat purchase of the product based on its environmental soundness.

Blend and van Ravenswaay (1999) performed a household survey and measured consumer demand for ecolabeled apples (ECO label and IPM label). The authors found that over half of respondentes were willing to try ecolabeled apples for the first time and that environmental concern significantly affected quantity purchased but food safety concerns didn't. Consistent with these results were the ones from Loureiro *et al*. (2002). These authors carried out a survey in a grocery store setting in Portland (USA) where the consumers had to choose between regular, organic and eco-labeled apples. WTP for eco-labeled apples was here

calculated through a double bounded logit model and the authors have concluded that being female, the presence of children under the age of 18 in the household, and the interaction of food safety concerns and attitudes about the environment positively affected the likelihood that a consumer will pay a premium for eco-labeled apples (ibidem, 2002).

But is there another side of the coin for ecolabled products? Bougherara *et al*. (2005) think that sometimes the net effect on the environment can be worse than the initial situation without ecolabelling, because the environmental unit improvement is compensated by an over-consumption of environmenatlly sustainable products. Therefore, in their analysis and in order to prevent this negative effect, the authors stress the need of complementary measures e.g. educating consumers or taxing products.

Another two well-known labels that signal credence attributes, are the organic and fair-trade labels. In 2005 researchers at INRA carried out a study intended to measure the wilingness to pay (WTP) for "organic", "fair-trade" and "organic fair-trade" labels (Tagbata and Sirieix, 2008). Their work tried to measure the value of the environmental or social dimension of a product using the BDM mechanism. Their findings showed that nearly one half of the consumers (of the sample) were insensitive to the presence of “organic” and “fair trade” labels on a product, appearing the price as the first criterion on which the choice of the products was based. For this segment the ethical arguments associated with the “organic” and “fair trade” labels were pushed into the background, behind other criteria like the taste and health issues.

However, the survey showed that for two other segments of consumers, these labels have a positive impact on the perception of the quality of the products which is materialized by a valuation of these labels corresponding to 20-30% of the product price (idem, 2008).

1.1 Experimental markets

The experimental markets design, described below, was defined.

The aim of this experiment was to measure the consumers’ willingness to pay (WTP) for apples and for a processed product (apple juice) produced with less pesticide. We also wanted to measure the impact of the cues which are the guarantee of the diminution of the pesticides’ use (IPM label – Integrated Pest Management - private or public certification, organic label, PDO label – Protected Designation of Origin).Another aim was to see if the potential diversity in consumer behaviour was depending on geographical location.

Finally, with this study we also wanted to compare two different methods to obtain the WTP: one direct method (direct sales with different prices with the Becker-DeGroot-Marschak (BDM) procedure[2] and an indirect method (choices between different size's lots of the preferred apple and any other apples).

The markets included both fresh products (apples from the two varieties *Royal Gala* and *Granny Smith* for Portugal's experience and Golden for the France's experience) and processed ones (apple juice). In order to see the impact of the cues, we used different apple types with different quality's certifications: i) Regular apples; ii) Integrated Pest Management (IPM) apples; iii) Retailer brand (the retailer requires IPM quality of his suppliers) apples; iv) Protected Designation of Origin (PDO) apples; v) Organic apples.

The regular apples correspond simply to the respect of the national legislation for the pesticides' use. The IPM apples correspond to a controlled reduction of these pesticides as compared to the existing legislation. This control can be done by the government (IPM label), by the retailer (retailer brand) or by the specific area producers (PDO label). The organic apples correspond to a total lack of the synthesis pesticides in the context of organic farming.

Apples were presented to the consumer with their labels (or without in the case of the regular apples which did not have any label). The labels were different in Portugal and in France (because of the language and of the country regulations):

- The IPM apples are defined as 'Protecção Integrada' in Portugal and as 'Production Fruitière Intégrée' in France.

- For the retailer brand apples, we worked with Auchan in Portugal (the label is: 'Vida Auchan, Qualidade Sustentável', i.e. 'Auchan's life, Quality Preservation') and with Carrefour in France (the label is: 'Engagement Qualité Carrefour', i.e. 'Carrefour's Quality Line').

- For the PDO apples, apples used in Portugal were from the 'Alcobaça' area and the one used in France were from the 'Limousin' area.

Also, we used different apples types in Portugal and in France. In the case of the Portuguese experience, we were careful to take into account the heterogeneity of tastes that can be observed in this market. For that, we asked to the consumers to make an advance tasting of

[2] Becker, G., DeGroot, M., Marschak, J. (1964). "Measuring Utility by a Single-Response Sequential Method". *Behavioural Science*, 9: 226-232.

two varieties: type "tart" with the Granny Smith variety and type "sweet" with the Royal Gala variety. These precautions made it possible, not only to limit the number of systematic refusals to purchase during the experiment, but also to prevent having consumers that proposed a purchase price equal to zero in whatever the selling situation.

In France, we proceed a bit differently. Thanks to the Portugal's results, we knew that around half of the participants would take the "tart" type apples (Granny Smith) and that the other half would take the other type: Royal Gala and particularly, we knew that no consumer was really against one type. So we decided to use only one variety but a quite common variety. We decided to work with the Golden variety, which is the most consumed type in France. Furthermore, to avoid any problem, we asked to all the participants which type of apple they usually consume and recruited only the one who answered at least the Golden type.

The other difference is the size of the apple. In Portugal, all the apples had the same calibre although in France, calibres were a bit different: the organic apple was a bit smaller than the other. So we had to add one small apple in order to not have just one small apple in the French experiments.

We also wanted to know the impact of pesticides reduction on a processed product: the apple juice. The different levels of pesticide reduction were: i) "Regular juice": juice obtained from regular apples; ii) "IPM juice": juice obtained from IPM apples; iii) "Organic juice": juice obtained from organic apples.

In both countries, the experiment included three stages:

Stage 1. **Sales of apples**

The objective of this stage was to measure consumers' WTP for pesticide reduction and to show how the results depended, or not, on a modification both of the intrinsic characteristics of the products (variety of apple, organoleptic quality, size, etc) and also of the extrinsic aspects (brand and origin of products). This is an important result when it comes to discuss how much the producers should reduce the pesticide level regarding the potential gain that can be obtained through a reinforcement of taste.

In Portugal, a lot of technical specifications regarding the characteristics of products were also measured in order to know their relevant characteristics ("Brix", acidity) and to estimate the correlation between WTP and these characteristics. With these measurements, we saw that the WTP is perfectly correlated to the hedonic note. We also saw that for the Royal Gala (variety with more sugar than the Granny Smith the WTP is positively correlated to the "Brix" and the

WTP is negatively correlated to the pH and that this is the opposite for the Granny Smith. So, because we had already these answers, we didn't do all the physicochemical measures in Dijon.

Stage 2. **Sales of apple juice**

The aim was to measure how the consumer response might be different according to the reduction of pesticides in the processed material. The changes verified in the WTP were then compared with those obtained previously with apples sales on stage 1.

Note that for stage 1 and stage 2, the value elicitation mechanism used was the Becker-DeGroot-Marschak mechanism.

Stage 3. **Choice of apple lots**

This stage assessed the robustness of the results obtained in comparing them to a situation of exchange (valuation of the Willingness to Exchange, WTE). The principle was the following. Based on the results obtained in stage 1 of the experiment, it was possible to identify the preferred alternative of each consumer. Each participant was then informed that this new stage consisted in making choices between different quantities (in Portugal) or weight (in France, because of the size differences) of apples of their preferred apple and the other apples.

The results obtained under these hypothetical trades allowed us to reconstitute the WTP of each consumer for the various certifications proposed. Thus, it was possible to measure the robustness of the WTP obtained in stage 1 of the experimentation.

1.3. Principal results

We show that there is a consumer WTP for pesticides use reduction (a premium for product with specific signal) and that specific information on pesticide use increases this WTP mainly for organic product. The most important result is that the specific information decreases the WTP for the regular product. Then it seems more rigorous to treat the results in terms of "premium against the regular product", anticipating the loss of market share for the regular product.

We showed that the most valuated cues for pesticide reduction is organic label. In Portugal, the premium for organic is 96.4% and for France is 72.5%. IPM certifications have also a high premium. However, producer's guarantee is more credible than retailer's. Moreover, we noted that sensory information may have a strong impact which should not be overlooked.

2. Protocols presentation

The aim of these experiments was the same in the two countries. After the first experiment in Lisbon, we changed a little bit the protocol for Dijon in order to improve this protocol according to Lisbon's results. That's why there are few differences between the 2 protocols.

2.1 Participants and session

The experimental protocol design was first applied in Portugal, in Lisbon, to 102 consumers and then in France, in Dijon, to 107 consumers.

In Lisbon, the experiments took place in the Agronomic University building. In Dijon, we worked in the INRA's sensory analysis room; INRA is the National Institute of Agronomic Research.

We did 11 sessions in Lisbon and 10 in Dijon (because the room was bigger in Dijon: we were able to receive 10 people maximum in Lisbon and 16 people maximum in Dijon). The session lasted around 1h30; it was at 2.30pm, 6pm and 8.30pm in Lisbon and at 3pm and 6pm in Dijon.

2.2 The recruitment

Participants were randomly recruited from the general population, according to a set of criteria, specific to this type of experience. For the recruitment, the same questions have been asked to the participants in Lisbon and in Dijon in order to have the same information about the consumers. The questions asked were about: i) apples consumption frequency; ii) participant's role in the food shopping in the family; iii) knowledge about apples prices.

We have especially assured that the participants were regular buyers of apples (at least once a week). If the answers met the criteria, i.e. the frequency consumption was at least once a week, participant was doing the shopping sometimes (at least once every two months) and the answer to the price they think for 1kg of apple was less than 5€ , we asked for all the socio-demographic data.

All the consumers recruited received a letter with explanation about the experiments but there were nothing said about pesticides. In this letter, it was explain that the subject of the study was the valuation of apples coming from different types of production.

2.3 Experimental procedure

As we said above, we used different apples that were distinguished by their labels:

- The producers' IPM apples were defined as 'Protecção Integrada' in Portugal and as 'Production Fruitière Intégrée' in France.
- For the retailer quality apples, we worked with Auchan in Portugal (the label is: 'Vida Auchan, Qualidade Sustentável', i.e. 'Auchan's life, Quality Preservation') and with Carrefour in France (the label is: 'Engagement Qualité Carrefour', i.e. 'Carrefour's Quality Line').
- For the IPM apples guaranteed by a specific producer's area, we used a 'Protected Denomination of Origin' certification (PDO). Apples used in Portugal were from the 'Alcobaça' area and the one used in France were from the 'Limousin' area.

Thus, we showed how the same guarantee of pesticide reduction may have different results whether it is provided by an ensemble of the chain upstream farmers (within the Integrated Pest Management charter or the framework of a denomination of origin) or by a retailer brand (the retailer himself assures that the farmers respect the pesticide reduction imposed).

For the five certifications (Regular – IPM – Retailer – PDO – Organic), we used five apples in Lisbon (one of each) but in Dijon, we had to use one more because of the difference in apples' calibre. Indeed, the organic apple we used in France was in a smaller calibre than all the other, so to decrease the impact of the size on the consumer perception, we add another small apple (which was actually the same as the organic one but without the label).

As we said above, there were three stages in the protocol: apples sales, apple juices sales and choices between sets of different types of apple.

At the end, there were the drawing lots. This part has been done to involve the participants properly in the experience; this is a proper part of the BDM mechanism. Because they are liable to buy one product, the participants are supposed to be more precise in their answers.

A. Stage 1

In this first stage, there were 4 steps. Il all steps, the consumers had to answer to the same question: "What is the maximum price you are ready to pay to buy 1kg of this apple?" but with different information.

- 1st step = intrinsic characteristics

At this step, the consumers did not have any information about the apples. This was a 'blind tasting'. The only information was the name of the variety because the participants can know it just by looking at the product. After the evaluation, the participants gave the maximum price they were ready to pay for 1kg of each apple they had tasted. At the end of this step, each consumer has given a maximum purchase price for 6 different apples.

There was a difference between Portugal's and French's experiments for this step. In Lisbon, participants had to taste 6 apples from two different varieties: 3 Granny Smith and 3 Royal Gala. In the two varieties, there was: 1 regular apple, 1 IPM apple and 1 organic apple. In Dijon, participants had to taste 6 apples from the same variety (the Golden variety). The apples were: 1 regular apple, 1 IPM apple, 1 retailer quality apple, 1 PDO apple, 1 organic apple and 1 small regular apple. Apples were evaluated 3 by 3, it means variety by variety in Lisbon and all the 6 simultaneously in Dijon.

In France, the whole experiment was carried on using only the Golden variety. In Portugal, for each participant, the prices' mean of the 3 apples for each variety has been calculated in order to find the preferred variety. If there were 2 equal means, the variety with the apple with the higher price was chosen. And in case of equality between the two first prices, the variety with the third higher price was chosen and so on. Only the preferred variety (Granny Smith or Royal Gala) was then used for the next steps.

Finally, in this step and only for Portuguese participants, they had to answer to a sensory analysis questionnaire: colour, texture, flavour and global taste.

- 2nd step = extrinsic characteristics without information

Then, in Lisbon, participant had to taste five different apples from their preferred variety: regular apple, IPM apple, retailer apple, PDO apple and organic apple. They had to taste six different Golden in France: the same one and one small regular apple.

The five (Portuguese's case) or six (French's case) apples were presented simultaneously to the participants with their labels. No information was given to the participant and they were not allowed to taste the products. They were asked to evaluate the apple in looking at, in touching at, in smelling at but without eating it and to answer to the question: "What is the maximum price you are ready to pay to buy 1kg of this apple?"

Note that at the end of this step, in Dijon, participants had to answer to few questions about their knowledge on labels used in the experiment. The question was: “For all the 6 apples you had evaluated, which guarantee do you think you have: a taste guarantee, an area origin guarantee, a pesticide reduction use guarantee?”

- 3rd step = extrinsic characteristics with information

At this step, each participant received an information sheet with the information about the label they were seeing on the apples. The consumers had to read the information sheet and then answer to the same question as before: “What is the maximum price you are ready to pay to buy 1kg of this apple?” At this step they were still evaluating apples without tasting them.

The information given to the participants were a bit different in Lisbon and in Dijon. For the regular apples, the information given was that the pesticides quantities used were following the legal instructions. In the case of IPM apples, we had simplified the information given to consumers, stating that it was a halving of the number and amounts of pesticides used in relation to the benchmark of the regular apple in Portugal and that it was a diminution (without any precision of the diminution’s proportion) in France. We specified to the consumers that the reduction was certified by the producers. For the retailer quality apples, we said to the consumers that there was a reduction of the pesticides use and that this reduction was certified by the retailer. When it was the PDO apples, the consumers were informed of the pesticide use reduction certified by the producers of a specific area (‘Alcobaça’ area for Portugal experiments and ‘Limousin’ area for the French experiments). In France, there were a precision that the reduction is warranted by the state from the PDO label. In the case of organic apples, consumers were informed of the synthesis pesticides use lack.

- 4th step = intrinsic and extrinsic characteristics with all information

Participants still had the 5 (Portugal) or 6 (France) apples in front of them. Now they had to taste the apples before giving their purchase prices in answering to the same question: “What is the maximum price you are ready to pay to buy 1kg of this apple?”

After this 4th step, the highest price was spotted to define the preferred certification for each participant. This preferred certification was the reference for the choices in stage 3. In case of equality the preferred certification was chosen by drawing lots.

B. Stage 2

The principle was exactly the same than the method which was used in the apple sales: BDM mechanism. The difference was that the participants did not have the product in front of them to make the valuation but only the labels of the products.

They had to answer to the following question: "What is the maximum price you are ready to pay to buy 1 Litre of this apple juice?" in looking at the 3 labels they had in their hands.

The different juices were issued of different apples: one regular apple juice coming from regular apples, one IPM apple juice coming from IPM apples and one organic apple juice coming from organic apples.

C. Stage 3

For this stage, we used the preferred certification defined at the end of the 4th step of the apples sales. The participants had all the information, they had the apples still on their table and they were allowed to taste the fruits again.

In this part, each participant had to make choices: i) between 1 fixed set (6 units in Lisbon and 1kg in Dijon) of his preferred certification and increasing sets of all the other certifications; ii) and then between decreasing sets of his preferred certification and 1 fixed set (6 units in Lisbon and 1kg in Dijon) of all the other certifications.

The difference between Lisbon and Dijon was due to the difference of apples size in Dijon. It was not possible to propose unit set in Dijon because, for instance, 6 regular apples are not similar in term of quantities to 6 organic apples. That is why we used quantities set in Lisbon and weight set in Dijon. Each participant had to complete 8 choice boards in Lisbon (because of the 5 different certifications) and 10 choice boards in Dijon (because of the 6 different certifications). Boards are like the one below:

- 4 like the one below in Portugal:

Quantity of apple of the preferred certification	**Quantity of apple of other certification**
6	6
6	7
6	8
6	9
6	10
6	11

- 4 like the one below in Portugal:

Quantity of apple of the preferred certification	Quantity of apple of other certification
6	6
5	6
4	6
3	6
2	6
1	6

- 5 like the one below in France:

Quantity of apple of the preferred certification	Quantity of apple of other certification
1 kg	1 kg
1 kg	1.150 kg
1 kg	1.300 kg
1 kg	1.450 kg
1 kg	1.600 kg
1 kg	1.750 kg

- 5 others like the one below in France :

Quantity of apple of the preferred certification	Quantity of apple of other certification
1 kg	1 kg
0.850 kg	1 kg
0.700 kg	1 kg
0.550 kg	1 kg
0.400 kg	1 kg
0.250 kg	1 kg

Finally, each participant drew lots for a sales or a choices situation. This drawing lot at the end was explained to the participants at the beginning to involve them. They knew that they were a possibility fro them to buy a product at the end of the session. At this stage, there were 2 possibilities:

- 1 sales situation was drawn lots: then the participant was drawing lots for a sale price. If this price was lower than the one he gave during the experience, the participant bought the product at the sale price (i.e. the less expensive). At the opposite, if the sale price was higher than the one given during the experience, the participant didn’t buy the product.

- 1 choice situation was drawn lots: the participant had to draw lots for one of the 48 lines in Lisbon and for one of the 60 lines in Dijon of the boards and received the apple set he had chosen on this line.

3. Results

3.1 Consumer's WTP after information about cues

With this experimental market, we showed that the most valuated cues for pesticide reduction is organic label. In Portugal, the premium for organic is 96.4% and for France is 72.5%. IPM certifications have also a high premium. However, producer's guarantee (using PDO) is more credible than retailer's. Moreover, we noted that sensory information may have a strong impact which should not be overlooked.

Table 1: Premium for each apple after complete information about cues

	Generic IPM	Retailer IPM	PDO IPM	Organic
Portugal	+ 53,6%	+42,9%	+73,2%	+96,4%
France	+43,6%	+30,7%	+62,4%	+72,5%

3.2 **Evolution of WTP for different labels**

The following figures (Figures 1 and 2) estimate the WTP of consumers for the three main stages of the experiment. The interval of 95% shows the statistical validity of WTP differences between the different logos.

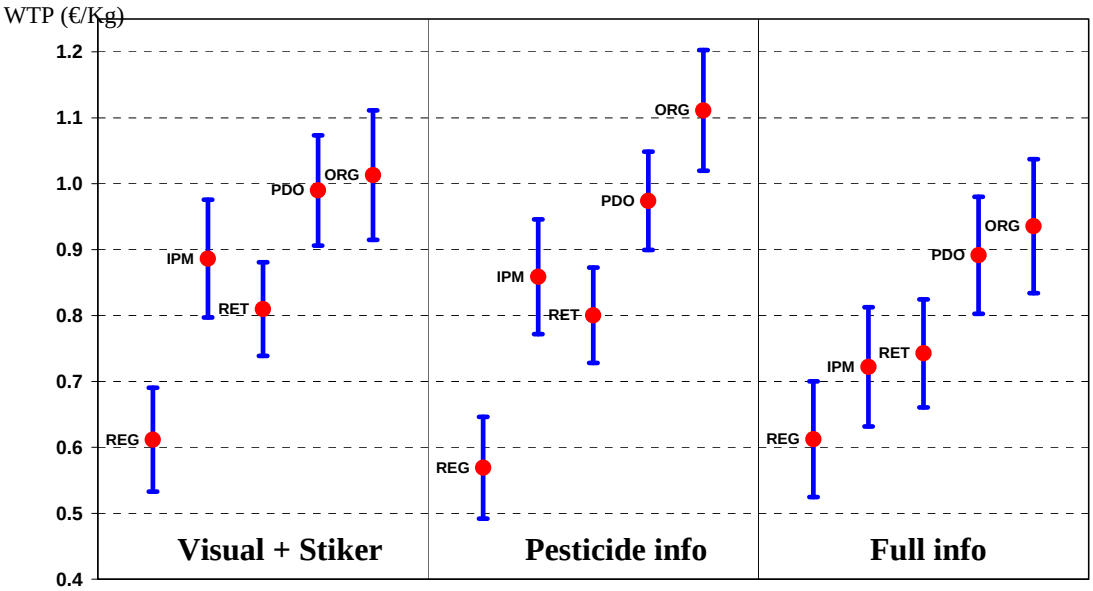

Figure 1: Mean WTP (95% CI) for Regular, IPM and Organic apples (Portugal)

In the two countries, we find that the most valuated cues are Organic and PDO. However, note that WTP for PDO is not due to pesticide reduction, because PDO is viewed as a signal of origin or a signal of taste (in our survey conducted in France, 83% of subjects believed that PDO is a taste guarantee!). It further notes that the information on pesticides did not improve the WTP for apples with a certification of origin. This result is found also for the retailer brand: a large majority (60%) of the subjects believed that this label did not certify a pesticide reduction. However, the contribution of the information has not increased the average consumer WTP.

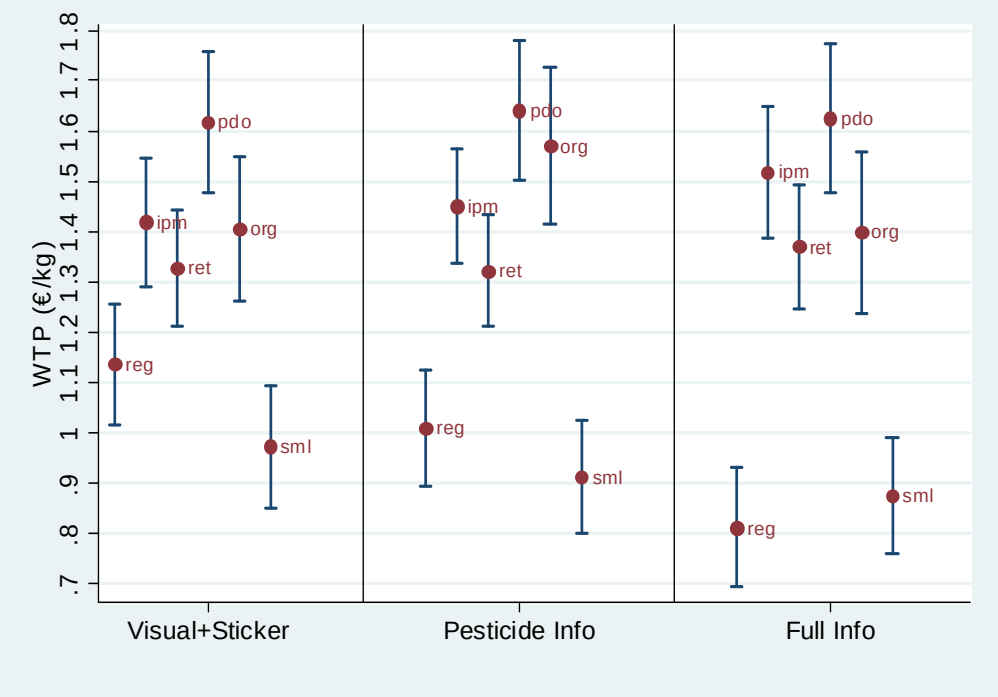

Figure 2 : Mean WTP (95% CI) for Regular, IPM and Organic apples (France)

However, the most important result is that specific information about pesticide decreases the WTP for the regular product. Then it is more rigorous to treat the results in terms of "premium against the regular product", anticipating the loss of market share for the regular product. Figures 3 and 4 show the results obtained, for the increasing of premium based on the information on pesticide reduction, in the case of IPM and organic product. We see that the premium given to IPM has increased to 42.6% after the information on pesticide reduction (only 24.6% before the information). Moreover, the premium given to organic apple fell to 55.4% after the information.

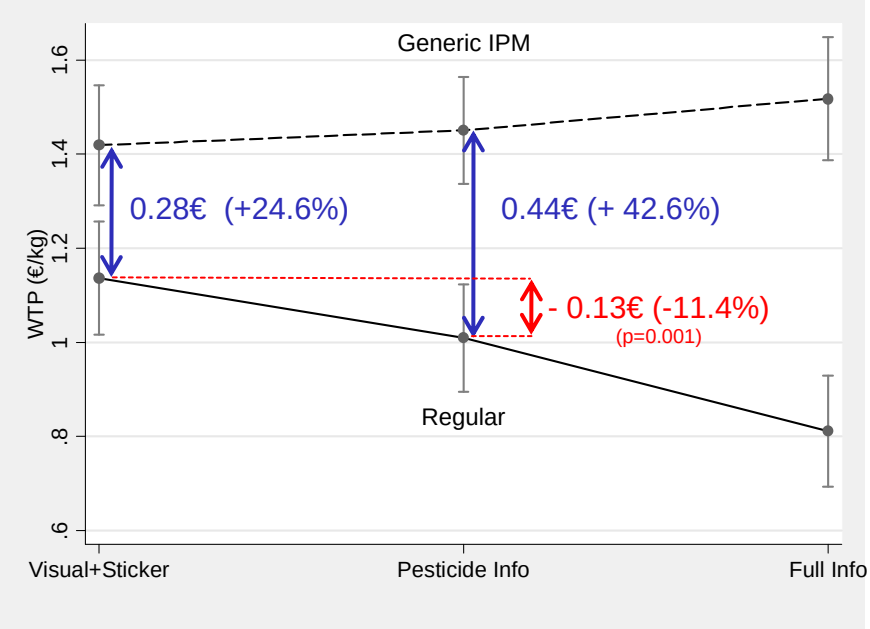

Figure 3 : Evolution of WTP after information on pesticide use

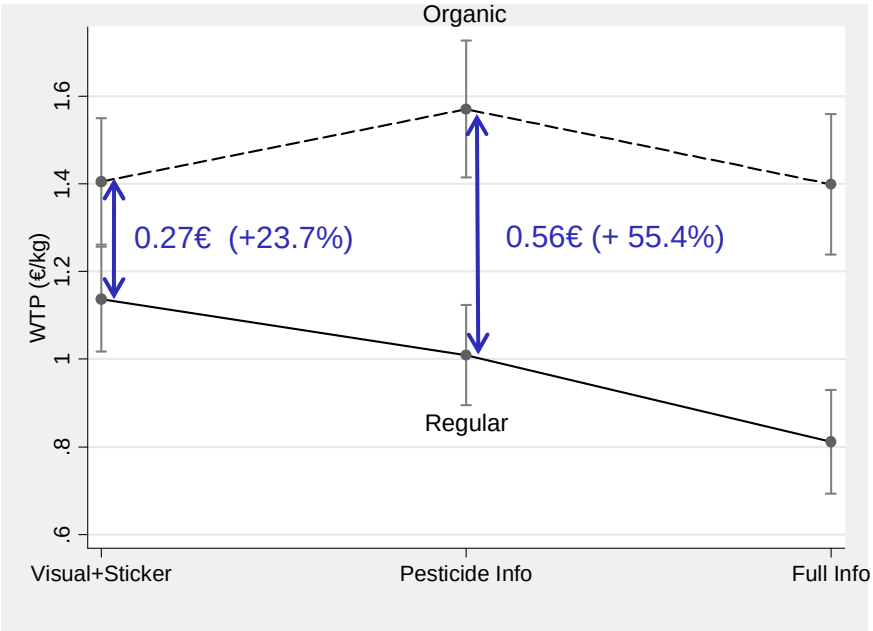

Figure 4 : Evolution of WTP after information on pesticide use

4. Policy Recommendations

In this deliverable, we evaluated the different instruments for signalling the reduction of pesticides, using experimental markets. For our experimental markets conducted in Portugal and France, consumers' WTPs were estimate using the apple example, for three levels of pesticide reduction: i) "Regular": apples produced in the respect of the legal legislation. These apples don't have any cue. ii) Integrated Pest Management (IPM): apples produced with a decrease of the pesticides' use. In our experimental markets, IPM strategy involved three different signals with a "generic" IPM certification, a retailer brand and a protected designation of origin, (iii) "Organic": apples produced without any synthesis pesticides.

We have shown that there is a consumer's WTP for pesticides use reduction (a premium for product with specific signal) and that specific information on pesticide use increases this WTP for organic product but not for IPM product. However, the most important result is that the specific information decreases the WTP for the regular product. Then it seems more rigorous to treat the results in terms of "premium against the regular product", anticipating the loss of market share for the regular product.

With this experimental market, we showed that the most valuated cues for pesticide reduction is organic label. In Portugal, the premium for organic is 96.4% and for France is 72.5%. IPM certifications have also a high premium. However, producer's guarantee (using PDO) is more credible than retailer's. Moreover, we noted that sensory information may have a strong impact which should not be overlooked.

In the different countries, we find that the most valuated cues are Organic and PDO. However, note that WTP for PDO is not due to pesticide reduction, because PDO is viewed as a signal of origin or a signal of taste. It further notes that the information on pesticides did not improve the WTP for apples with a certification of origin. This result is found also for the retailer brand: a large majority (60%) of the subjects believed that this label did not certify a pesticide reduction.

In summary, the results that we have obtained, confirm that it is possible to assess the alternatives for having consumers contribute to the improvement of environmental practices. It appears that a public certification of pesticides' reduction is more credible for consumers than a private certification. Therefore it is particularly necessary to signal the efforts made to consumers in terms of pesticide reduction, strengthening public certification and signalling, via logos, this certification. It could also be particularly effective to include environmental efforts (with a certified procedure of IPM) in the appellations of origin.

For the IPM strategy, improving information about pesticides reduction has no significant impact on the WTP. However, information about pesticides' reduction has a significant negative impact on regular products. Indeed, while the labels may convey positive messages to consumers about the production conditions, they may simultaneously stigmatize the conventionally produced products by highlighting perceived problems related to pesticide residues.

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