

LESSONS FROM TEN YEARS OF AN INTERPROFESSIONAL SURVEY PLAN ON OILSEEDS FOOD SAFETY

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ABSTRACT

French oilseeds food chain operators are coordinated through a food safety survey plan, in order to get a realistic picture of the contamination in oilseed products (seeds, oilseed meal, and vegetable oil). Concerned crops are those cultivated or processed in France: rapeseed, sunflower and soybean. Grain storage companies, feeding industries and oil industries participate voluntarily, and send their self-data that are pooled in a database. Thirty-three companies are actively involved, providing each year about 60000 to 180000 analytical results coming from about 2000 to 3000 samples of seeds, meals and oils (note: on one sample, several contaminants can be analyzed giving several analytical results). Pesticide residues represent more than 90% of the analytical results of this database as the laboratories can determine a large number of active substances with multi-methods. Other sought contaminants are: trace elements (cadmium, lead, arsenic, mercury, fluorine), mycotoxins (mainly aflatoxin B1 and total aflatoxins), toxic organic compounds (polycyclic aromatic hydrocarbons, dioxins and PCBs), microbiological contaminants (salmonella in meals), botanical impurities (eg seeds of *Datura spp.* in sunflower seeds), mineral oils or compounds likely to be formed during refining such as esters of 3-MCPD and glycidyl esters in oils. The food safety of oilseeds survey plan allows to identify which are main concerns, for instance post-harvest insecticide residues from cross contamination during storage. Results of this monitoring plan were transmitted to the French government and the European Commission in cases of regulatory threshold revisions (eg for cadmium in oilseeds, for the revision of pirimiphos-methyl thresholds).

Key words: Oilseeds, vegetable oil, survey plan, contaminants, pesticide residues

INTRODUCTION

The French oilseed food supply chain got together with food safety issues since the early 2000s that correspond to the establishment of a set of European regulations called “Hygiene Package” (Dauguet et al, 2006). In this context, the food safety survey plan (called PSO) was implemented from the 2005 campaign, helping to control the quality of products (seeds, meal and oil) in a interprofessional framework. Since PSO was launched, more and more operators of the oilseed supply chain have become active partners. This article gives a review of the seven years of the PSO.

Today, each operator of the food chain is facing a legal obligation:

- to implement a HACCP approach, based on sound analysis of health risks inherent in its business,
- to ensure the sanitary compliance of products that it puts on the market,

- to carry out self-monitoring.

The PSO, set up by Terres Inovia, ITERG and Terres Univia since 2005, is an observatory of the sanitary quality of oilseed products in France (Lacoste et al, 2005). This survey plan is based on a shared private database on oilseed contaminants. This base is fed by self-monitoring data from industries (crushing industry and feed industry) and storage agencies that join this PSO, as well as by series of analyzes on seeds, meal and oil by Terres Inovia, ITERG and Terres Univia (figure 1).

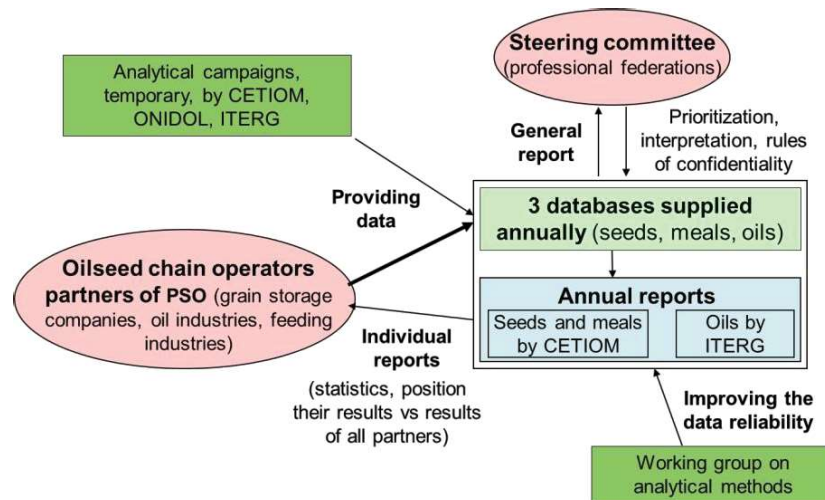


Figure 1. Organization of the Oilseed Survey Plan (PSO)

Intended for storage agencies to industrial oil processors and feed manufacturers, the PSO deals with:

- oilseeds: rapeseed, sunflower, soybean
- products: seeds, meals, crude and refined oils, byproducts of refining
- contaminants: residues of plant protection products, trace metals, mycotoxins, toxic organics, salmonella, botanical impurities ...

The confidentiality of data is guaranteed for partners, and no commercial exploitation of this database is made. The database on seeds and meals is managed by Terres Inovia, and the database on crude and refined oils is managed by ITERG.

So, the PSO is a tool of the oilseed supply chain, allowing a collective coordination on the safety aspects, highlighting progress and contributing to setting realistic regulatory thresholds. It represents also a forum for exchange of information between the operators in the sector, where are identified relevant research avenues.

A GOOD REPRESENTATIVENESS

To date, the PSO has 33 active partners: 28 grain storage agencies distributed throughout France, which represents 30-40% of the of the French oilseed harvest, 4 oil industrials (the main groups in France) and 1 partner in the feed industry, the OQUALIM association, which brings together 57 feeding companies (over 71% of the feed production). The representativeness of the PSO partners is correct. This plan is open to all interested companies and new members join it every year. Thus, each partner provides analysis data from its own self-monitoring data, and annually receives an individual report with its results compared to regulatory limits and to the overall PSO results: a moderate analytical investment gives access to a rich database, allowing refining its risk analysis.

For the last ten years, the PSO collected data annually from about 2,000 to 3,500 samples of seeds, cake, oils, and providing between 40000 and 120000 analytical results per

year (several contaminants checked in each sample). Plant protection products residues (pesticides) represent over 90% of the results. The other investigated contaminants are: metal and mineral trace elements (cadmium, lead, arsenic, mercury, fluorine), mycotoxins (aflatoxin B1 and total aflatoxins essentially), toxic organic (PAHs, dioxins and PCBs), microbiological contamination (salmonella cakes), botanical impurities (seeds of *Datura spp.* in sunflower seeds), mineral oils or compounds likely to form during refining such as the esters of 3-MCPD and glycidol esters in the oil.

THE PSO RESULTS

PSO allows us to check that almost all oilseed products comply with the regulations. Regulatory limits on oilseeds are defined in different texts: maximum limits for pesticide residues (MRLs, EC Regulation No. 396/2005 and Regulations amending it), maximum levels in feed (Directive 2002/32 / EC and texts the modifying) maximum levels in foodstuffs for human consumption (Regulation No. 1831/2003 and other regulations amending it).

However, PSO provides the observation that oil refining is necessary to remove some pesticide residues from crude oils. These are mainly insecticide residues, coming from post-harvest treatments (pirimiphos-methyl, chlorpyrifos-methyl, deltamethrin), applied on the empty storage cells or on cereal grains stored in the same sites, and being incidentally found on oilseeds by cross-contamination (Dauguet, 2007; Dauguet, 2009). These molecules are then removed at various steps of oil refining, and therefore marketed refined oils are pesticide free.

Through the PSO, the real effort provided by crushing plant in order to control the microbiological quality of the meal could be checked: today salmonella nearly disappeared in rapeseed and sunflower meals produced in France.

The PSO suggests that mycotoxins are a danger almost inexistent for oilseeds, considering the regulated toxins. Only aflatoxin can be detected occasionally in sunflower, but at very low levels, far below the regulatory threshold. But monitoring of aflatoxins should as a regulatory threshold for aflatoxins in human food has been fixed for oilseeds intended for direct human consumption (2 mg/kg for aflatoxin B1 and 4 mg/kg for total aflatoxins) without industrial processing (confectionery sunflower), with a much higher maximum levels in feed (20 mg/kg for aflatoxin B1). For other not yet regulated toxins such as toxins of *Alternaria*, EFSA recommends Member States to acquire data in food. Within PSO, analyzes of these toxins have been carried out and their presence can be seen occasionally on sunflower. However, toxicological studies are not sufficiently substantiated to date to conclude on the risk posed by the toxins of *Alternaria*.

The trace metals are not a family at risk as oilseeds never exceed these regulatory limits. In the case of cadmium, the concentrations found in the sunflower seeds and meal can be sometimes close to the threshold in animal feed (1 mg/kg).

A contaminant was identified recently in the PSO: *Datura spp* seeds, which are botanical impurities that can be found in sunflower seed crops. This weed is toxic, since it contains tropane alkaloids, and the presence of *Datura spp.* seeds is regulated in the raw materials for animal feed (1000 mg/kg of whole seeds of *Datura*). Indeed, the alkaloids contained in these impurities will be transferred in the meal after the oil extraction process.

Organic toxic substances, such as polycyclic aromatic hydrocarbons (PAHs) and dioxins and PCBs, are specifically monitored in crude and refined oils. The levels measured for these substances show that these substances do not pose a problem in the French oilseed sector.

Recently, the presence of esters of 3-MCPD and glycidol esters has been reported in refined vegetable oils, and in formulated food products containing vegetable fats (Zelinková, 2006). Palm oil is the oil with the highest infection rates likely related to the high temperatures used

during deodorization of physical refining, while the seed oils are generally less prone to the formation of this contaminant (Kuhlmann, 2011). The few results collected via the PSO confirm the low contamination of refined rapeseed and sunflower oils.

Following a sunflower crude oil contamination from Ukraine by mineral oils (Lacoste, 2010), manufacturers have established since 2008 a systematic verification of import sunflower oil. The data collected within the PSO showed that the contamination in 2008 was an isolated case.

PSO, A TOOL FOR THE OILSEED FOOD CHAIN

The results of PSO therefore enable operators in the sector to carry out an analysis of health hazards in oilseed products. Thus, the subject of post-harvest insecticide residues appeared important. This encouraged the operators to carry out specific actions to identify the sources of cross-contaminations of oilseeds by these pesticide residues in storage facilities. Surveys conducted in collaboration with companies have enabled the identification of these situations leading to cross-contamination (Dauguet, 2007; Dauguet, 2009), and recommendations were relayed by the federations. According to the latest PSO results, the contents of these pesticide residues tend to decline.

The PSO has also been involved to argue for re-examine the maximum residue level of pirimiphos-in oilseeds, taking into account the phenomenon of cross-contamination during storage. This data were studied by EFSA which issued an opinion (EFSA, 2011) in which European food safety authority says that an MRL of 0.5 mg/kg would be suitable for oilseeds (while the current MRL was 0.05 mg/kg).

As part of the review of the regulatory thresholds of cadmium in food, PSO partners have also mobilized to provide the public authorities with data so that future limits are not an obstacle to trade in oilseeds. This issue mainly concerns the sunflower, which accumulates cadmium in its seeds. Today, none sunflower sample exceeded the regulatory threshold for feed, but a lower threshold could be a problem. Finally, this regulation does not apply to oilseeds. PSO data were transmitted to the French authorities in the context of the European discussions on the revision of cadmium thresholds, with the agreement of all PSO's members. This also illustrates the value of reliable data to assist in setting realistic regulatory thresholds.

CONCLUSION

The PSO is now considered a sustainable action for the benefit of operators in the French oilseed sector, which has no equivalent in other countries. In 2016, new means of communication and information are available for PSO members, with a dedicated and protected website. This provides more responsiveness and flexibility: more ease for online data entry and data reading.

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