



COCERAL MYCOTOXINS SURVEY: SYNTHESIS REPORT 2013

**Results of the Mycotoxins survey
carried out among COCERAL members**

November 2014

EXECUTIVE SUMMARY

COCERAL has first carried out a survey among its members regarding mycotoxin management in 2007. The survey was repeated in 2009, 2011 and latest in 2013. Over the time, some questions have been adapted or added to the survey but essentially with the continuing objective to gain an overview on of mycotoxins management carried out by COCERAL members.

COCERAL members are on the one hand grain collectors and international traders of cereals, rice, feedstuffs, oilseeds and others but also agrosupply distributors, who often advise farmers all along the production cycle - on the choice of seed varieties and the of use of fertilisers and plant protection products.

The first part of the survey focuses specifically on agrosupply distributors' contribution to prevention of mycotoxins risk in the field. Almost all agrosupply distributors participating in the 2013 survey that advise farmers inform about practices aimed at minimising mycotoxin development on cropland, for example by recommending fusarium resistant seeds or adapted fungicides treatments or generally advising on agricultural practices. Further to the advice provided, mycotoxin risk management of farmers normally improves.

The second section of the survey aims at sampling and testing practices pursued by grain collectors and international traders. They intervene after the grain is harvested. Collectors mainly test at harvest or in store but also at loading before transport or at delivery to the first processing industry. When importing, testing tends to take place at delivery whereas in intra EU-trade, testing is done mostly in store or at loading before transport.

With almost 100% of survey participants indicating that they sample their lots to monitor mycotoxins, this highlights an increasing awareness of mycotoxin issues. In 2011, it was only 86%. Survey participants were also asked which crops they sample on which mycotoxins. From the 2013 results, wheat appears to be the most tested crop, but also maize undergoes several testing. Some change in the testing patterns could be observed when comparing the replies with the 2011 survey: in general, barley and oat seem to have been tested more back then; also for example T2 HT2 testing was done at a higher level on maize than on wheat, different to 2013 survey findings. Compared to 2011, the 2013 survey suggests a reverse trend from contractual methods or CEN method EN/ISO 24333 towards the use of official control regulation sampling plans and even more so towards internal methods.

When carrying out mycotoxin analysis internally, operators use both bandage kits and quantitative methods of analysis. When rapid analysis is required, collectors and traders also frequently use external analysis. However, external analysis is also used to validate analysis carried out internally, or to complement for missing data, for example when internal testing equipment is not available.

According to the 2013 survey, a significant number of participants have had to recall a lot due to exceedance of regulatory limits, compared to a very low level in 2011. While the few recalls in 2011 were predominantly due to commercial complaints, in 2013 it was mainly consequences of an official control. This may be a reflection of the very high level of official controls carried out in the past two years.

REGULATORY SITUATION

Foodstuffs

The Commission Regulation (EC) No 1881/2006 of 19 December 2006 sets maximum levels for certain contaminants in foodstuffs, amongst others for mycotoxins.

Feedingstuffs

Recommended guidance values for different mycotoxins in animal feed, feed materials and feedingstuffs are available through Commission Recommendation 2006/576/EC from 17 August 2006 on the presence of deoxynivalenol, zearalenone, ochratoxin A, T-2 and HT-2 and fumonisins in products intended for animal feeding. Commission Directive 2002/32/EC on undesirable substance in animal feed foresees maximum levels for aflatoxin B1 and rye ergot (*Claviceps purpurea*) in feed materials.

Recommendation regarding presence of T-2 and HT-2 toxins

Discussions on T-2 and HT-2 toxins have been going on for several years. In March 2013, the Commission published a recommendation regarding the presence of T-2 and HT-2 toxin in cereals and cereal products. Member States are asked to perform, with the active involvement of feed and food business operators, a monitoring for the presence of T-2 and HT-2 toxin in cereals and cereals products. In the case of repetitive findings of levels above the indicative level within a certain period of time, investigations on the effects of feed and food processing on the presence of T-2 and HT-2 toxins shall be performed.

The recommendation includes indicative levels for the sum of T-2 and HT-2 ($\mu\text{g}/\text{kg}$) for unprocessed cereals, cereal grains for direct human consumption but also for cereal products for feed and compound feed (rice and rice products are not included).

Maximum levels for mycotoxins in food and feed

The table here below summarizes the limits and guidance values for food and feed.

Table 1: Summary of current limits for mycotoxins

Mycotoxins		Foodstuffs Regulated maximum levels	Feedingstuffs levels
STORAGE MYCOTOXINS	Aflatoxins	<ul style="list-style-type: none"> - Sum of B₁, B₂, G₁, and G₂: - 4 ppb for cereals and products derived from cereals (excluded maize, rice and processed cereal products, baby foods and dietary foods for infants); - 10 ppb and 5 ppb (B1) for maize and rice; - Aflatoxin B₁: - 2 ppb for cereals and products derived from cereals (excluded maize, rice and processed cereal products, baby foods and dietary foods for infants); - 5 ppb for maize and rice; - 0.1 ppb for processed cereal-based foods and baby foods for infants and young children. 	Regulated levels for Aflatoxin B₁: 20 ppb for feed materials
	OTA (Ochratoxin A)	<ul style="list-style-type: none"> - 5 ppb for unprocessed cereals; - 3 ppb for all products derived from unprocessed cereals including processed cereal products except if for infants. 	Recommended guidance values: 250 ppb
FIELD MYCOTOXINS	DON (Deoxynivalenol)	<ul style="list-style-type: none"> - 1250 ppb for unprocessed cereals other than durum wheat, oats and maize - 1750 ppb for unprocessed durum wheat and oats; - 1750 ppb for unprocessed maize with the exception of unprocessed maize intended to be processed by wet milling (starch production). - (rice is excluded from “unprocessed cereals”); 	Recommended guidance values: 8 000 ppb for cereals and cereal products (12000 ppb for maize by-products)
	ZEA (Zearalenone)	<ul style="list-style-type: none"> - 100 ppb for unprocessed cereals other than maize; - 350 ppb for unprocessed maize with the exception of unprocessed maize intended to be processed by wet milling (starch production). - (rice is excluded from “unprocessed cereals”); 	Recommended guidance values: 2 000 ppb for cereals and cereal (3000 ppb for maize by-products)
	FUMONISINS B1+B2	<ul style="list-style-type: none"> - 4000 ppb for unprocessed maize with the exception of unprocessed maize intended to be processed by wet milling (starch production). 	Recommended guidance values: 60 000 ppb for maize and maize products
	Sum of T-2 and HT-2 toxin indicative levels from which in case of repetitive findings, onwards investigations should be performed (Commission recommendation)	<p>Unprocessed cereals:</p> <ul style="list-style-type: none"> -200 ppb for barley (including malting barley) and maize -1000 ppb for oats (with husk) -100 µg/kg for wheat, rye and other cereals 	500 ppb for other cereal products

INTRODUCTION

This report aims to show the results of a biannual survey on the management of mycotoxins carried out by COCERAL members.

COCERAL is considered as the voice representing the European cereals, rice, feedstuffs, oilseeds, olive oil, oils and fats and agrosupply trade. COCERAL members act in the food and feed supply chain, both at the level of agrosupply distributors and grain traders (Figure 1).

Agrosupply distributors often advise farmers all along the production cycle - on the choice of seed varieties and the use of fertilisers and plant protection products, also taking into account the local conditions (environmental, pedo-climatic, economics, etc.). Many agrosupply distributors also provide information about the time of intervention on the crop, the role of meteorological conditions, or the correct dosage for the chosen product.

Grain collectors and international traders intervene after the grain is harvested. Collectors sample and analyse the crops at reception. Then they dry, clean and protect the grain from insect infestations in order to adapt the crops to both the regulatory requirements and the commercial contracts.

Agrosupply distributors and grain trading operators contribute to the management and control of mycotoxins in the batches traded within European Member States.

This report will highlight which tools and actions are put in place to manage the risk of mycotoxins by agrosupply distributors and grain traders.



Figure 1 Composition of the food and feed supply chain. COCERAL members act before and after the farmers as agrosupply distributors, grain collectors and international traders.

SURVEY DESIGN

- **Population of concern**
 - European agrosupply distributors and grain trading companies;
 - The survey includes replies from Austria, France, Greece, Hungary, Italy, Poland, Spain, Sweden and the UK.
 - The operators from the member states who replied to the survey are members of national associations of COCERAL.
- **Inquiry setting**
 - Operators have been consulted via a questionnaire (see Annex 1) sent to them by email.
 - The inquiry was launched on the 7th of March 2014 and closed on the 28th March 2014. A second round of inquiry was launched on the 7th of May and closed on the 16th of May 2014.
 - The COCERAL Secretariat received 28 replies, covering a total volume of traded grains of 41 million tonnes.

The description of the method for processing the replies design can be found in Annex 2.

STARTING DATA

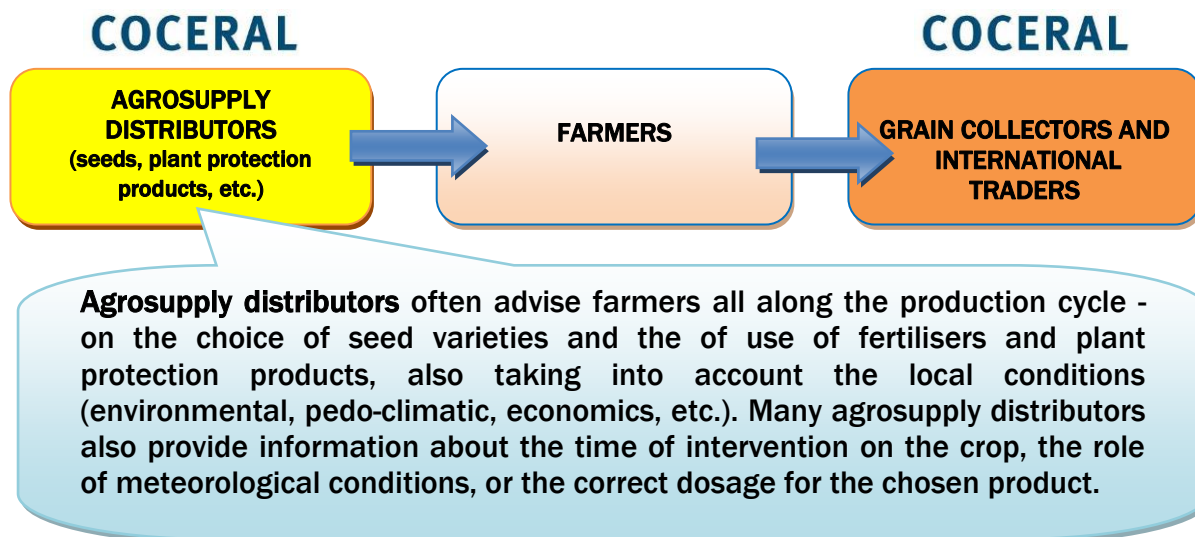
- The survey starting data was collected through the questionnaire. The participants were asked to specify the volume of grain traded on a yearly basis and the number of farmers the operator is dealing with.
- All data received from operators from the same Member State were aggregated.
- **Volume of traded grains**
 - The volume of traded grains is composed of the volume collected from European farmers and of grains imported into the European Union.
 - The results of the questionnaire are expressed proportionally to the total volume of grains traded within each member state.
 - The external data on EU imports and intra-EU trade is sourced from Eurostat.

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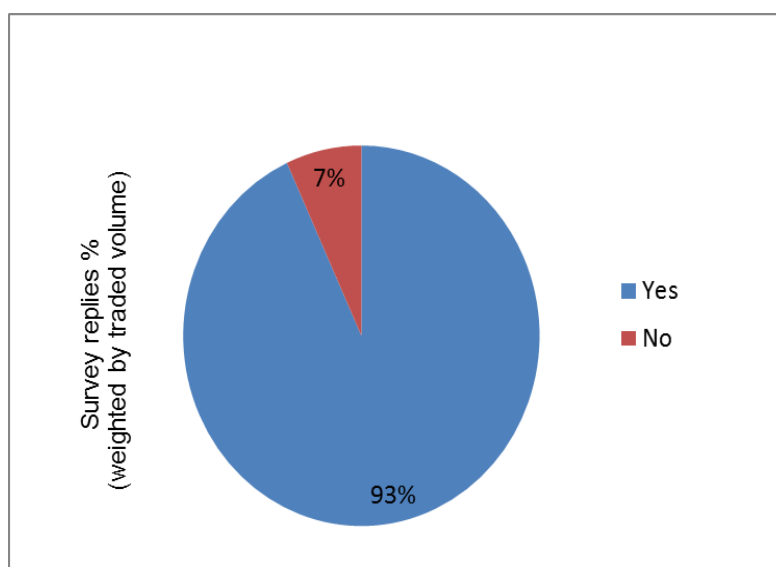
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1 Prevention of mycotoxins risk in field

This section refers to the agrosupply section members of COCERAL.

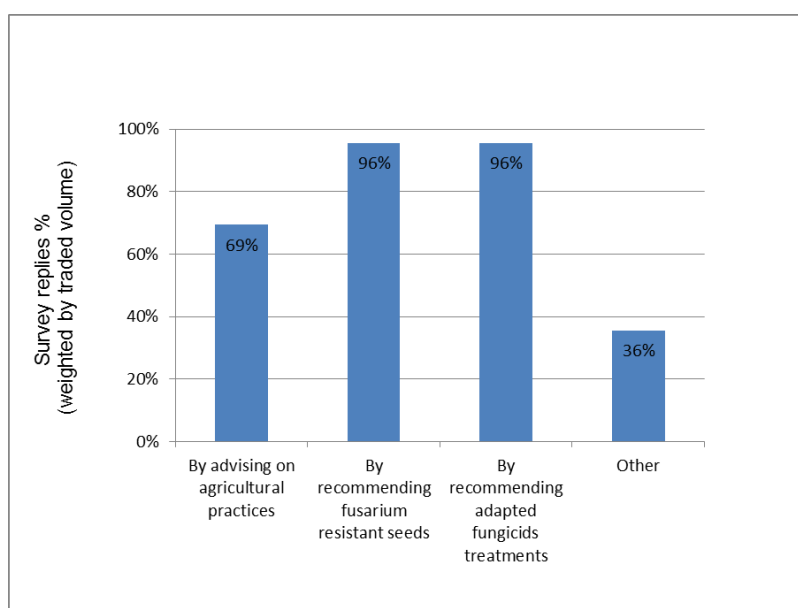


1.1 Do you specifically advise farmers with regard to mycotoxins?



93% of the agrosupply distributors indicated that they advise farmers on practices aimed at minimising the risk of mycotoxin development on cropland. This highlights that mycotoxin management is a key concern for COCERAL agrosupply members, and that operators use their role to contribute to the management of mycotoxins in field.

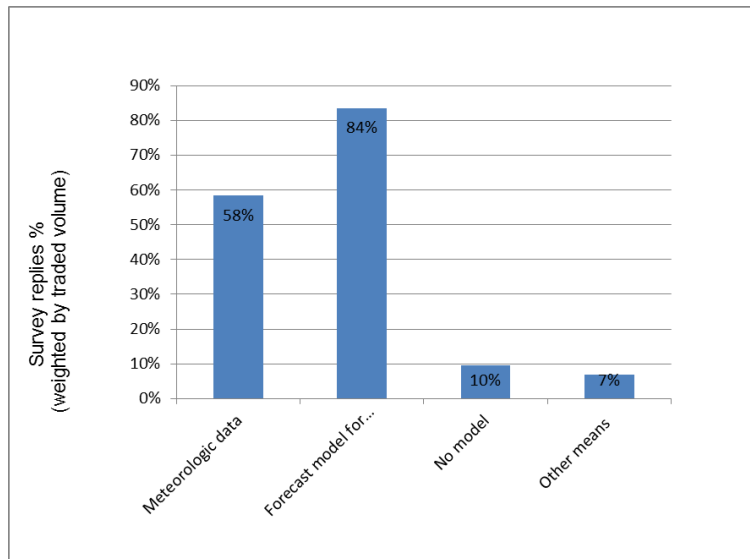
1.2 How do you manage field mycotoxins risks? (multiple answers possible)



As in 2011, when advising farmers with regard to mycotoxins, agrosupply distributors put their emphasis on recommending fusarium resistant seeds and specific fungicide treatments. More often than in 2011, they provide advice on agricultural practices. Another approach pursued in one country is through industry agreed best practice approaches, detailing risk and strategies for minimizing risk.

Furthermore, agrosupply distributors generally also sell the seeds and fungicides they recommend (replies to question 1.3 Do you sell the recommended seeds or fungicides?).

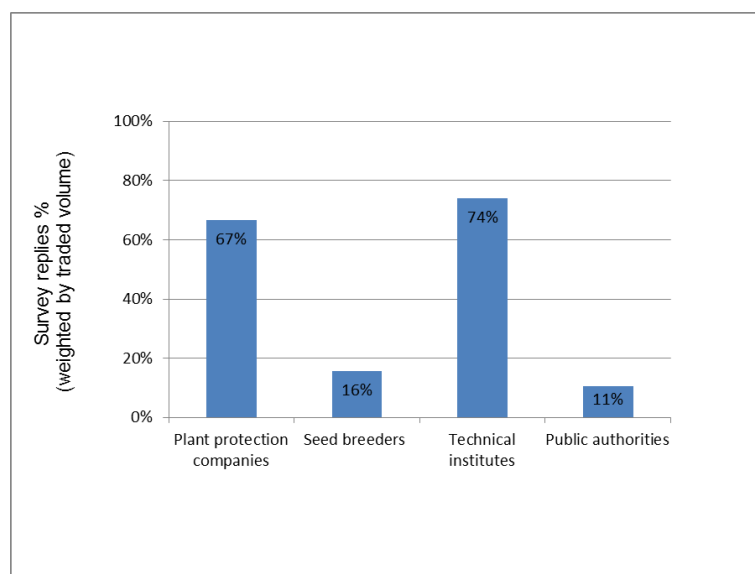
1.4 When advising the farmers, which models do you use? (multiple answers possible)



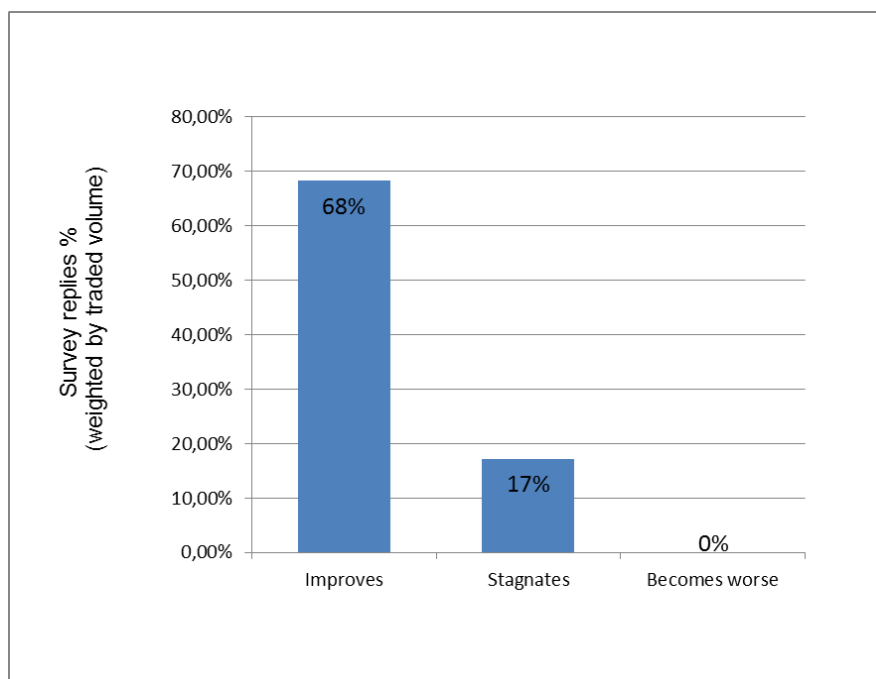
The dominant models agrosupply distributors use when advising farmers seem to be forecast models for fusarium or mycotoxin risk. The percentage has increased from 65% to 84% from the last survey in 2011 among agrosupply distributors. Also meteorological data is used by an increasingly large part (only 39 % in 2011). Some also use other means such as observation, or provide online tools. Fewer respondents than in 2011 indicated that they use no model (about 30% in 2011).

If the forecast model is used, this is normally proposed by plant protection companies or technical institutes (see graph below). Compared to the 2011 survey results, the role of plant protection companies' input has doubled; Technical institutes used to be even more dominant as providers of forecast models (84% in 2011).

1.4.1 If you use the Forecast Model, by who is it proposed?



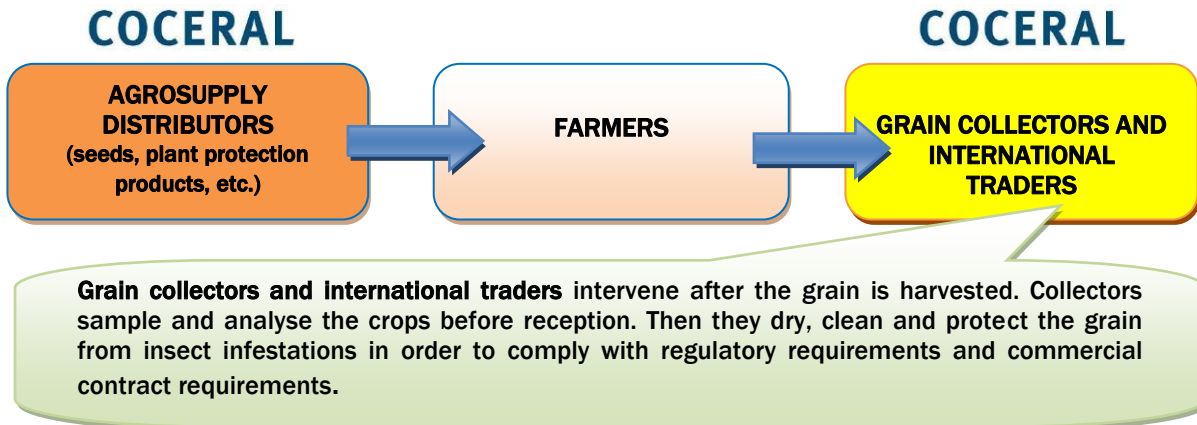
1.5 Further to the advice to farmers the mycotoxins risk management improves, stagnates or becomes worse?



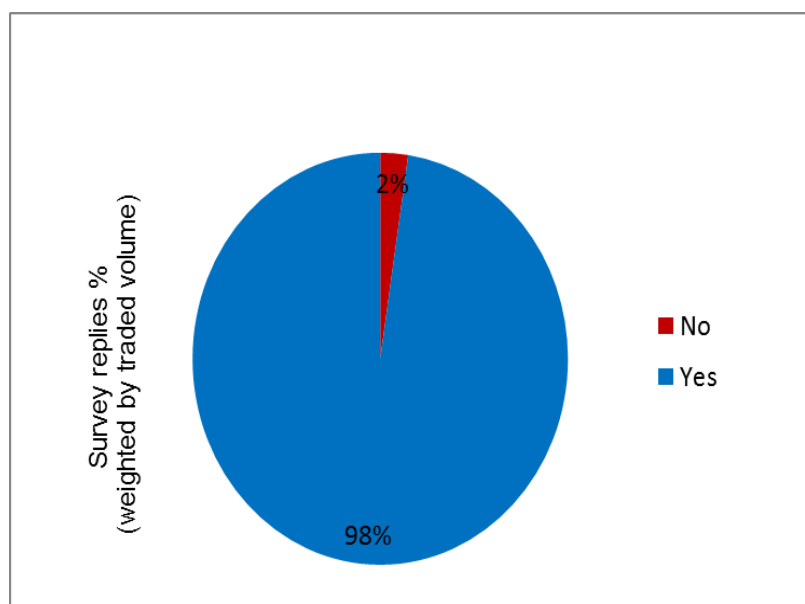
The agrosupply distributors advising farmers on agricultural practices normally observe an improvement of the mycotoxin risk management of farmers (almost 70%). However, compared to 2011, the level seems to have decreased slightly: in 2011 even 74% of the respondents stated that they saw improvements. By further enhancing the collaboration between the principal actors involved and gathering more knowledge concerning the mycotoxins and their prevention, distributors continuously aim to improve the situation.

2 Sampling, detection and analysis

This section refers to grain collectors and international traders members of COCERAL.

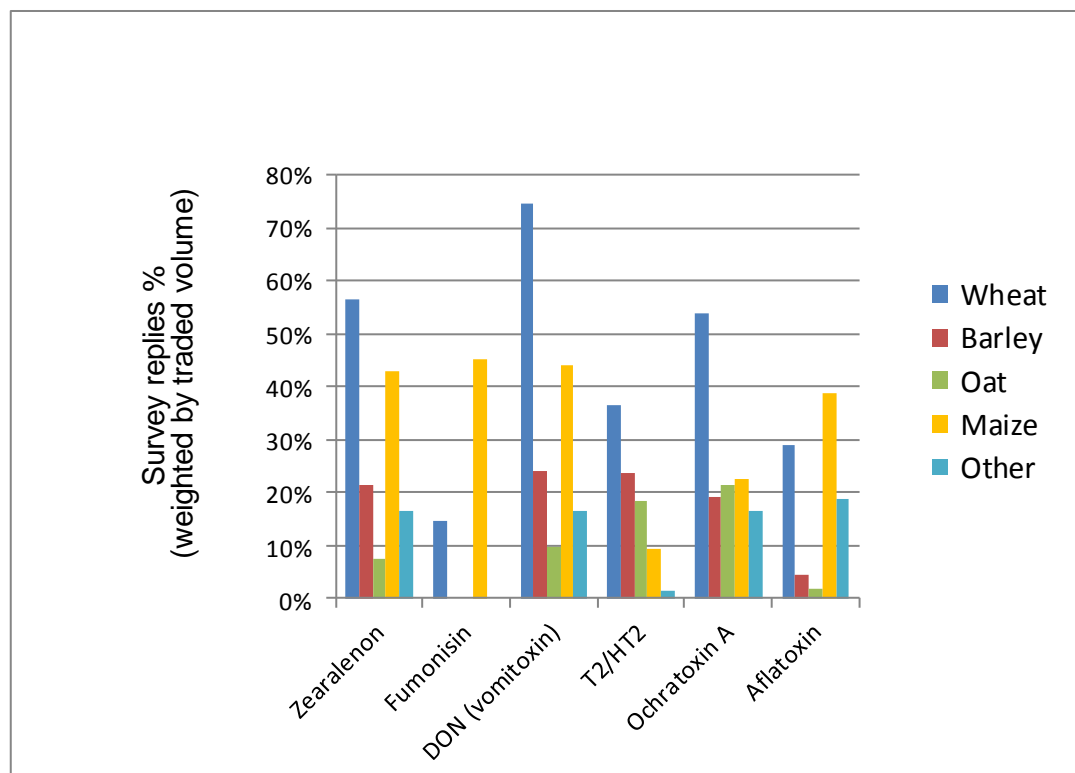


2.1 Do you sample your lots to monitor mycotoxins?



This graph highlights the growing awareness and extent of the level of monitoring that operators put in place for mycotoxin detection: almost 100% of the respondents to the survey indicated that they carry out mycotoxin sampling operations on their lots; in 2011 it was still a level of 86%.

2.1.1 If you sample your lots to monitor mycotoxins, which mycotoxin do you test for? (multiple answers possible)



This chart indicates the level of testing of different crops in regard to the different mycotoxins.

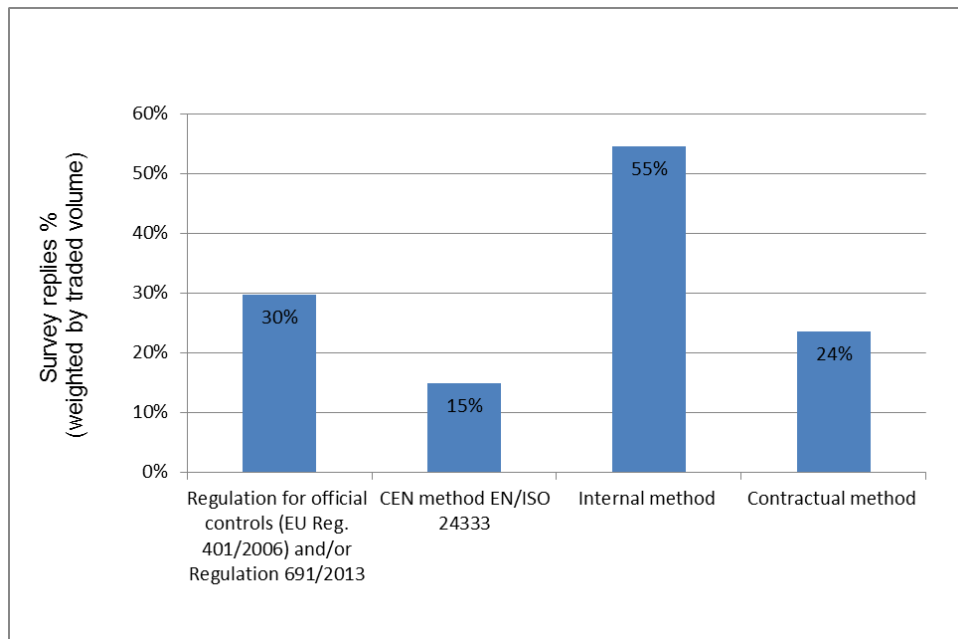
Wheat appears to be the most tested crop, with DON being the mycotoxin tested by the largest number of operators. At least 50% of the participating operators test wheat also on zearalenon and on ochratoxin A. **Maize** also undergoes several testing with about a third of the respondents testing samples on zearalenon, fumonisin, DON and aflatoxin; the data also indicates that fumonisin and aflatoxin testing is performed more on maize than on wheat.

The survey findings suggest that oat and barley or other crops are less frequently tested on mycotoxins than wheat and maize.

In comparison to survey replies in 2011, some changes in testing patterns can be observed:

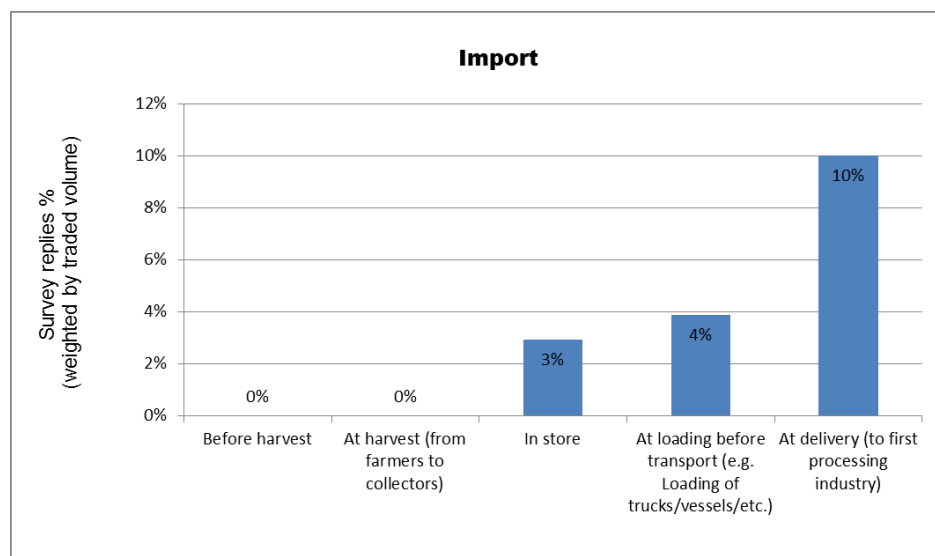
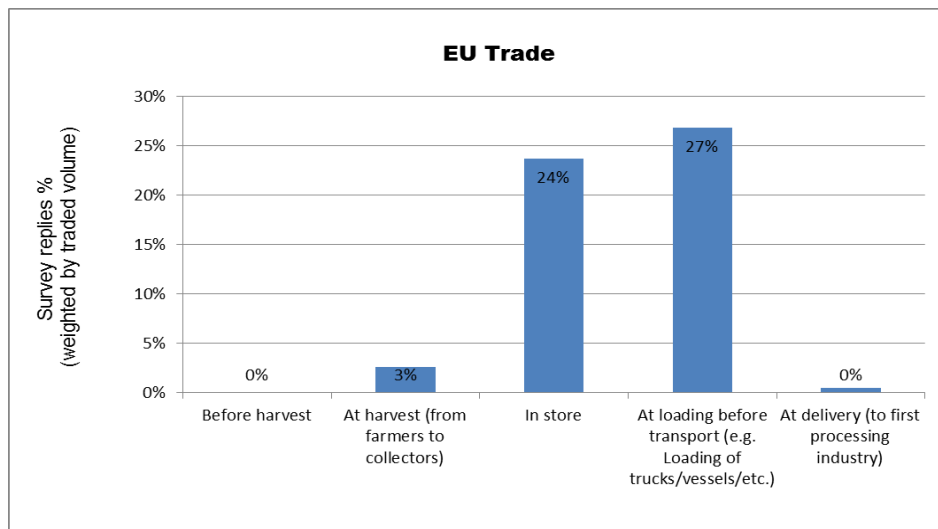
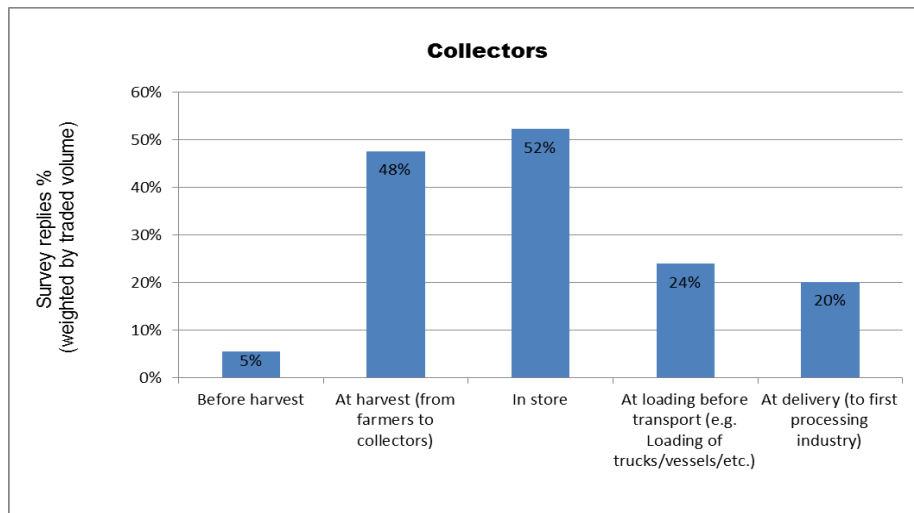
On zearalenon, a higher level of testing was done on wheat, barley and oat; fumonisin was also tested more often, that is also on barley and oat. Many more operators indicated that they tested barley on DON than they did in 2013. T2 HT2 testing was done at a higher level on maize than on wheat. For ochratoxin A, there was generally more testing on all crops in 2011 than indicated in the 2013 survey. Regarding aflatoxin, while in 2013 survey results indicate that the testing was concentrated on wheat and barley, in 2011 testing was done also at a regular level on barley and oat.

2.2 Which sampling method is currently used by your business for the mycotoxin analysis?

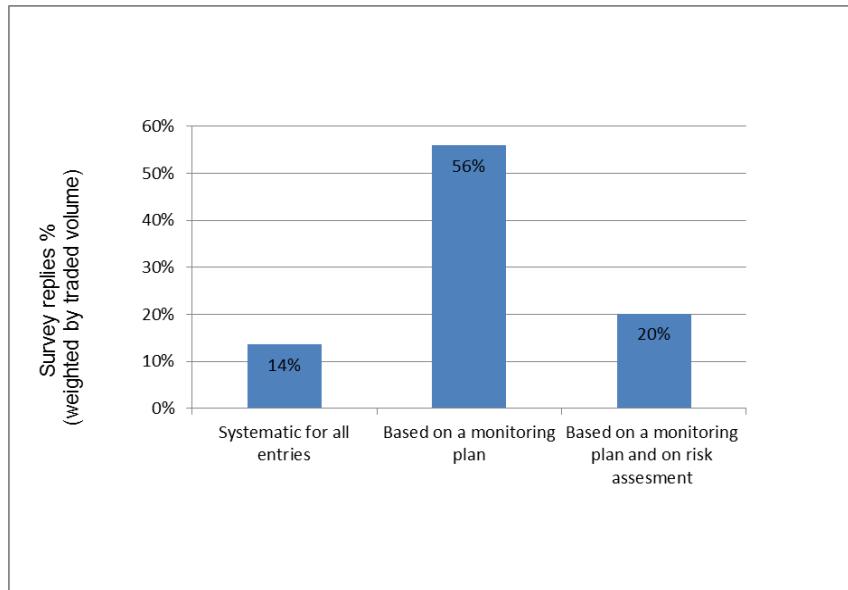


Compared to 2011, the results of the survey suggest a reverse trend from contractual methods or CEN/ISO standards towards official control sampling plans and to a larger extent to internal methods of sampling. Since 2009, the use of contractual methods has undergone an unsteady development; from an insignificant level in 2009 it increased in 2011 and decreased again according to the 2013 survey results. Contractual sampling requirements seem to often demand the application of GAFTA 124. Other methods operators use are ICC Standard 130 or industry sampling guidelines.

2.3 When do you test for mycotoxins? (multiple answers possible)

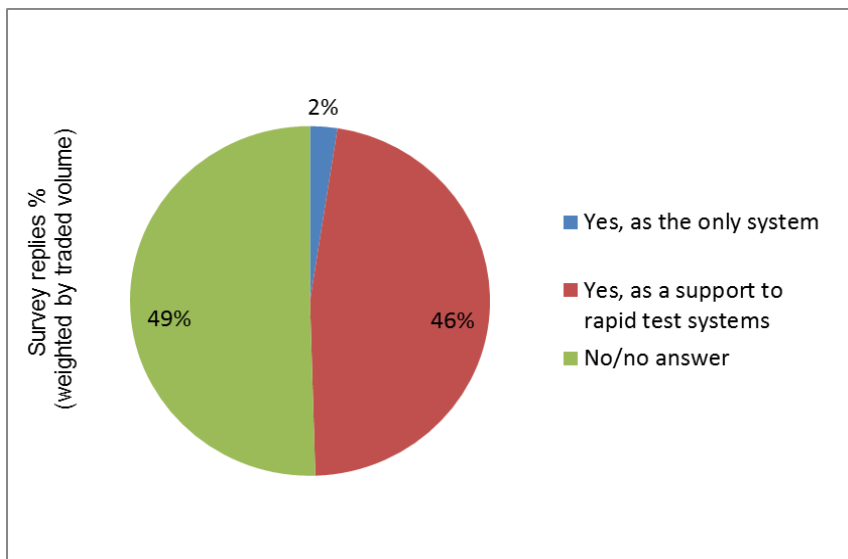


2.4 Which frequency of testing are you applying? (multiple answers possible)



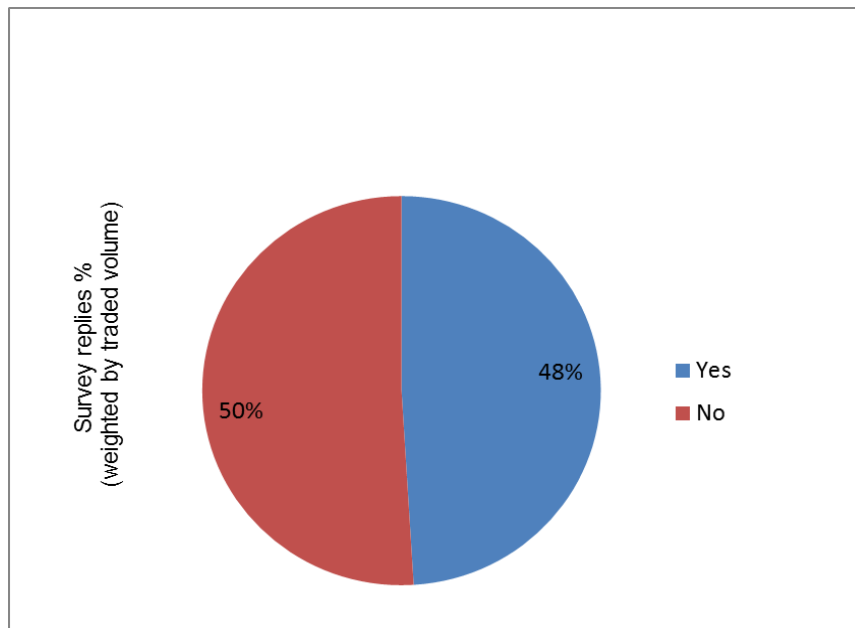
Those operators that perform mycotoxin testing normally follow a monitoring plan (76%). A significant part (20%) additionally includes a risk assessment. 14% even perform systematic testing for all entries.

2.6 Do you carry out visual tests?



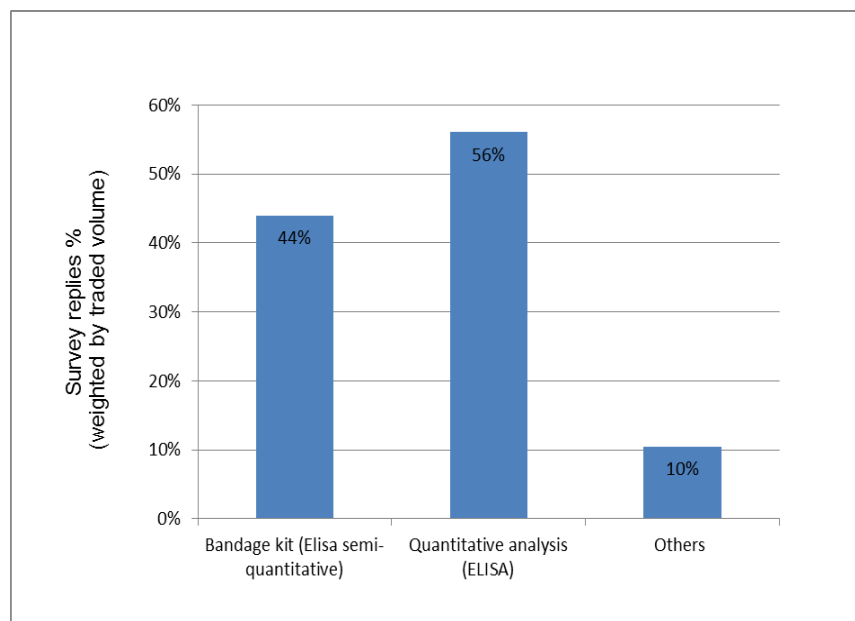
About 50% of operators carry out visual tests as a support to rapid test systems. Such practice seems to be increasingly common; in the 2011 survey, only 19 % indicated that they would do so.

2.7 Do you carry out mycotoxin analysis internally?



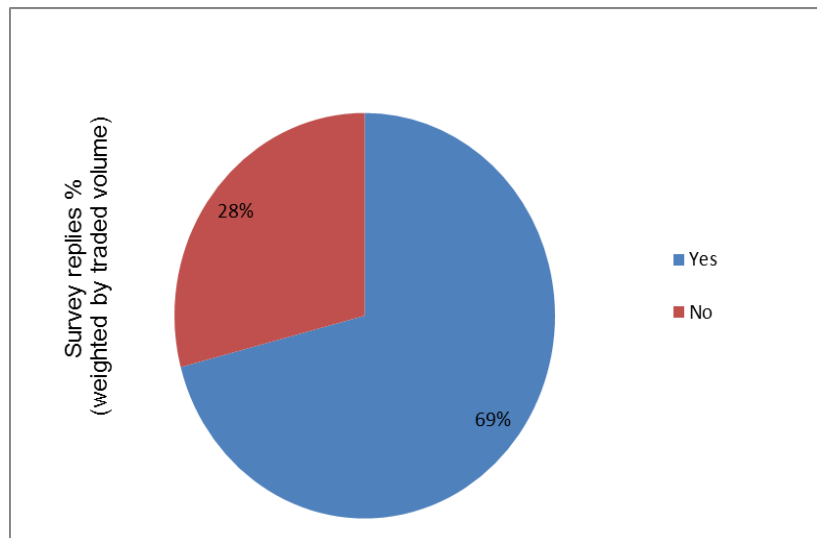
The level of internal testing of mycotoxins increased to almost 50% from a level of 35% in the 2011 survey.

2.7.1 If you carry out mycotoxin analysis internally, which kind of method of analysis do you use? (multiple answers possible)



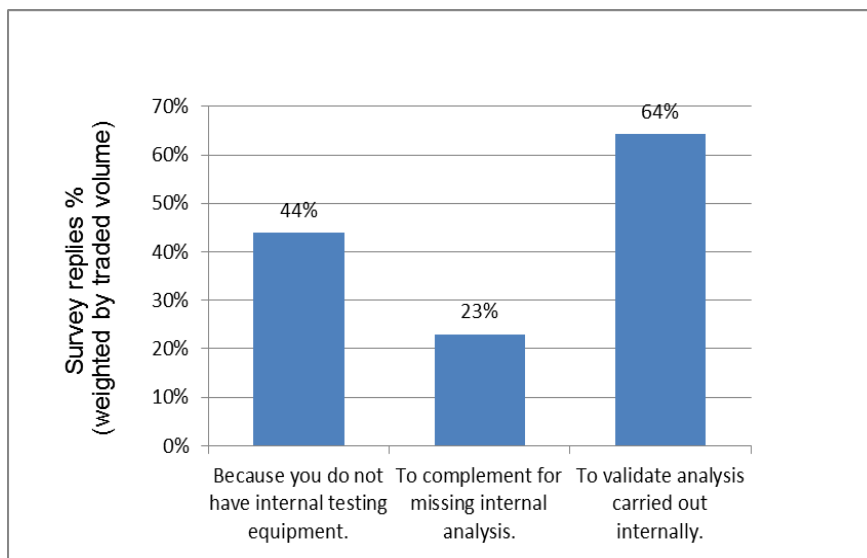
The graph indicates a balanced use of bandage kits and quantitative analysis. According to the 2011 findings, quantitative analysis (ELISA) was apparently far more dominantly used (83%) than now.

2.8 Do you carry out external analysis for the mycotoxin monitoring?



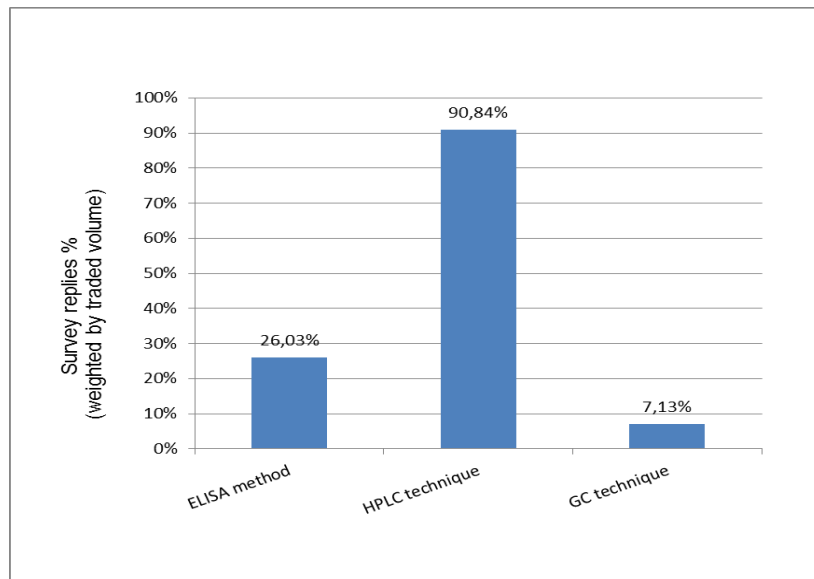
Rapid analysis is required when a lot is received at a silo or warehouse and therefore rapid tests to support on-site decisions of lot acceptance are frequently used. Compared to 2011, there seems to have been a decrease in the level of carrying out external analysis, from 80% in 2011 to about 70% in 2013. One could conclude that there has been a shift from external to internal testing as the level of internal testing has increased.

2.8.1 If you carry out external analysis for the mycotoxin monitoring, what is the purpose? (multiple answers possible)?



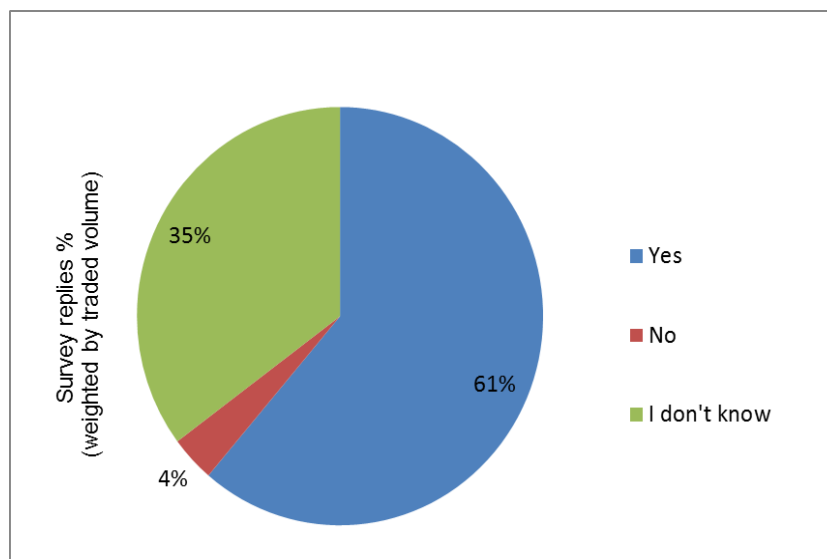
External analysis is also used to confirm the results of internal testing and/or to provide for missing data. While in the survey from 2011, providing for missing internal data was the main rationale indicated for carrying out external analysis (79%), in the 2013 survey the reason mentioned most often was to validate analysis carried out internally.

2.8.2. If you carry out external analysis for the mycotoxin monitoring, what is the kind and methodology used by the lab? (multiple answers possible)?



Compared to the 2007 and the 2009 surveys, the use of ELISA methodology in external labs has increased again. HPLC seems to remain the most used technique for external analysis since 2007 (95% in 2011); the use of GC technique has decreased from 33% to 7% from 2011.

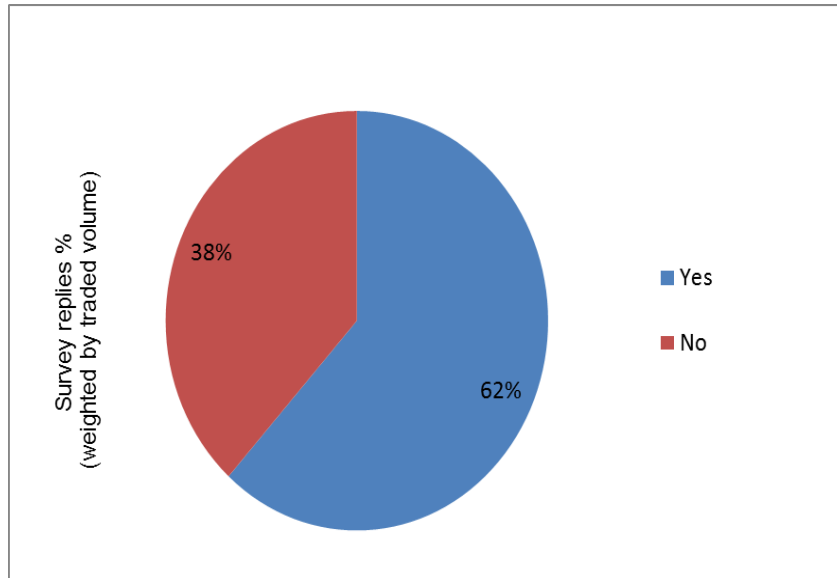
2.9 Is your laboratory accredited to EN17025?



Since 2007, the number of laboratories used that are accredited with EN17025 seems to have significantly increased. This is a positive development as accredited laboratories must publish the level of uncertainty linked to the analysis they perform which enhances the level of transparency and the comparability of analysis results.

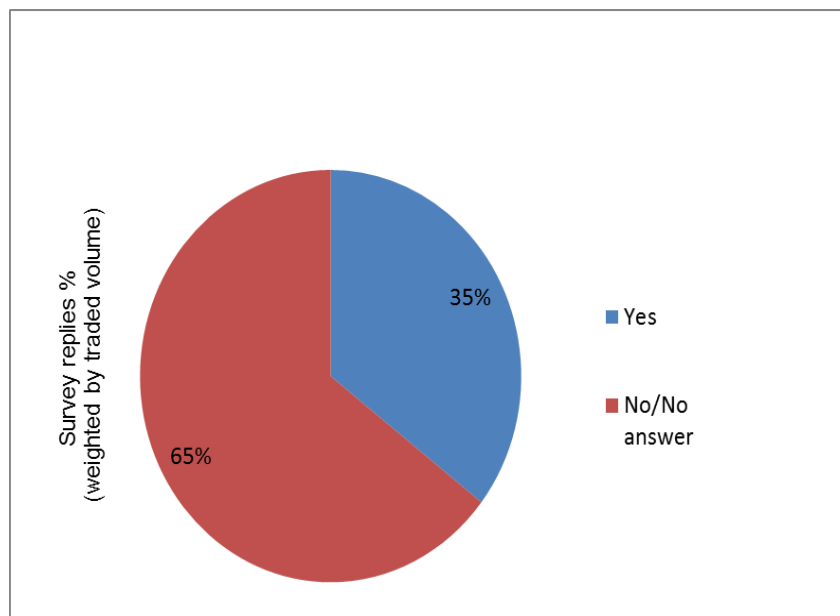
2 Regulation enforcement and controls

3.1 Have you already been controlled within the framework of the official regulation on mycotoxins?



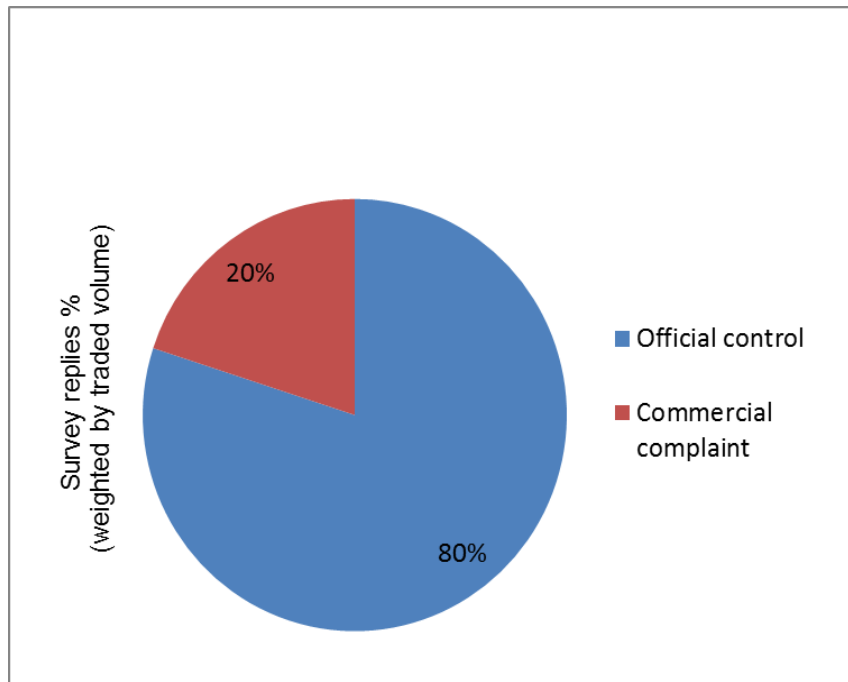
According to the survey replies, 62% of operators have been controlled within the framework of the official controls regulation on mycotoxins.

3.2 Further to exceeded regulatory limits, did you have to recall a lot?



In the case that there was an exceedance of regulatory limits, 35% had to recall a lot. In the replies to the 2011 survey, this was only the case for 4%.

3.3 If you had to recall a lot, was it a consequence of an official control or of a commercial complaint?



The reason why operators had to recall a lot has experienced a complete turnaround: While in the 2011 survey, recalls were due to commercial complaints in 62% of the cases, this percentage decreased to 20% in 2013. On the other hand, the recalls from an official control increased from 38% in 2011 to 80% in 2013. This may be a reflection on the very high level of official controls carried out in the past two years.

Annex 1: QUESTIONNAIRE “MYCOTOXIN MANAGEMENT” 2014

YOUR COMPANY (several possibilities)

- Advises and sells seeds and Plant Protection Product (PPP)** (see Part 1)
↳ To how many farmers:
- Collects from farmers** (see Parts 2 et 3)
↳ Collected volume (2012/2013): tons
- Traded volumes in the EU** (see Parts 2 et 3)
↳ Volumes purchased from collectors (2012/2013): tons
- Imports grains into the EU** (see Parts 2 et 3)
↳ Imported volume (2012/2013): tons

1. PREVENTION OF FIELDS MYCOTOXINS RISKS

1.1 Do you specifically advise farmers with regard to mycotoxins?

- YES
 NO (if no, please go to part 2)

1.2 How do you manage field mycotoxins risks?

- By advising on agriculture practices (till, former crops...)
 By recommending Fusarium resistant seeds
 By recommending adapted fungicides treatments
 Other (please specify):

1.3 Do you sell the recommended seeds or fungicides?

- Yes
 No

1.4 When advising, do you use:

- Meteorologic data
 A forecast model for Fusarium or mycotoxins risk
 No model
 Others means (please describe)

1.4.1 If you use the Forecast Model, by who is proposed?

- Plant protection companies
 Seed breeders
 Technical institutes
 Public authorities

1.5 Further to the advice to the farmers, the mycotoxin risk management:

- Improves
- Stagnates
- Becomes worse

2 SAMPLING, DETECTION AND ANALYSIS

2.1. Do you sample your lots in order to monitor mycotoxins?

- NO: please go to part 3
- YES:

2.1.1 If Yes, which ones? Please tick the cells of the table below for each crop/toxins combination

	Wheat	Barley	Oat	Maize	Other (please specify)
Zearalenon	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fumonisin	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
DON (vomitoxin)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
T2/HT2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ochratoxin A	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Aflatoxin	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2.2. Which sampling method is currently used by your business?

- Regulation for official controls (EU Reg. 401/2006 (food) and/or Regulation 691/2013 (feed))
- CEN method EN/ISO 24333
- Internal method – please specify
- Contractual method (for example GAFTA 124) – please specify

2.3. When do you test, according to your activities?

	Before harvest	At harvest (from farmers to collectors)	In store	At loading before transport (e.g. loading of trucks/vessels/ etc.)	At delivery (to first processing industry)
Collector	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
EU trade	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Import	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2.4. Which frequency of testing are you applying?

- Systematic for all entries

- Based on a monitoring plan
- Based on a monitoring plan and on risk assessment (please specify)

2.5. Are you certified under any food and/or feed safety management schemes (for example GTP Code, GMP+FSA, GMP of OVOCOM, FEMAS, UFAS, TASCC, Q&S, CSA-GTP, GTAS, ISO 22000)

- Yes
- No

2.5.1 If YES, please specify under which certification scheme you are accredited.

2.6 Do you carry out visual tests?

- Yes, as the only system
- Yes, as a support to rapid test systems
- No

2.7 Do you carry out analysis internally in your own company?

- Yes
- No

2.7.1 If YES, which kind of method of analysis do you use in your company?

- Bandage kit (Elisa semi-quantitative)
- Quantitative analysis (Elisa)
- others (please specify)

2.7.2 Who is/are your supplier(s) of the quick tests?

	Bandage kit (Elisa semi-quantitative)	Elisa (quantitative)
Charm	<input type="checkbox"/>	<input type="checkbox"/>
Neogen	<input type="checkbox"/>	<input type="checkbox"/>
R-Biopharm	<input type="checkbox"/>	<input type="checkbox"/>
Other (please indicate)	<input type="checkbox"/>	<input type="checkbox"/>

2.8 Do you carry out analysis externally?

- Yes
- No

2.8.1 If YES, what is the purpose of the external analysis?

- Because you do not have internal testing equipment
- To complement for missing internal analysis
- To validate analysis carried out internally

2.8.2 If YES, what is the kind and methodology used by the lab?

- Elisa method
 - Standardized method (please specify):
 - Internal method (please specify):
- HPLC technique
- GC technique

2.9 Is the laboratory you use accredited EN 17025 for the mycotoxins you tested for?

- Yes
- No
- I don't know

3. REGULATION ENFORCEMENT AND CONTROLS

3.1. Have you been already controlled within the framework of the official regulation on mycotoxins?

- Yes
- No

3.1.2 If YES, by whom? (Please, indicate by which public service)

3.2. Further to exceeded regulatory limits, did you have to recall a lot?

- Yes
- No

3.3 If yes, was it a consequence of an official control or of a commercial complaint?

- Official control
- Commercial complaint

4. Other comments on mycotoxin management

ANNEX 2: METHOD DESIGN

- **Method design**

- The replies sent by the operators are assumed to be representative for the whole country they represent.
- Each participant specified the volume of cereals traded; the total volumes mentioned representing 21% of the total volume of cereals traded in those countries.

- **Calculation steps and formula**

- The reply to each question was weighted by the total contributions received for that country thus returning the country's-dependent mean reply: R_C (%)
- The volume of grains traded within each country was divided by the volume of grains traded within all the countries participating in the survey, thus obtaining W_C .
- The overall result, R (%), was obtained as the average of all member states-dependant mean (R_C) weighted by W_{MS} (weight of the member state).

$$R = \sum_{MST} R_C * W_C$$

Where R (%) = overall result

R_C = mean reply for member state (%)

$W_C = \frac{V_C}{V_{All}}$; where V_C = Volume traded in the participant country

V_{All} = Total volume of countries participating to the survey