



COCERAL MYCOTOXINS SURVEY: SYNTHESIS REPORT 2023

Results of the Mycotoxins management survey
carried out among COCERAL members

Published in July 2024

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, oilseeds, pulses, olive oil, oils and fats, animal feed 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 considering 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**
 - The operators who replied to the survey are members of national associations of COCERAL, which are European agrosupply distributors and grain collecting/importing/trading companies.
 - The survey includes replies from Austria, Belgium, Bulgaria, Croatia, Denmark, France, Greece, Hungary, Ireland, Italy, the Netherlands, Romania, Spain, Romania, and the UK.
- **Enquiry setting**
 - Operators have been consulted via a questionnaire (see Annex 1) sent to them by email.
 - The enquiry was launched on 22 June 2023 and closed on 15 October 2023
 - The COCERAL Secretariat received 19 replies, covering a total volume of traded grains of 36 million tonnes (equivalent to more than 16% of total EU market share).

The description of the method for processing the replies 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.

EXECUTIVE SUMMARY

Preamble:

Mycotoxins are toxic secondary metabolite that are naturally produced by different types of fungi (i.e., *Aspergillus* spp, *Penicillium* spp, *Fusarium* spp, and *Claviceps* spp). Mycotoxins might enter the food chain because of infection of crops before (field mycotoxins) or after harvest (storage mycotoxins) and are typically found in cereals and oilseeds, meant for human and animal consumption.

“The presence of mycotoxins in food and feed may cause adverse health effects in humans and animals, ranging from gastrointestinal and kidney disorders to immune deficiency and cancer.

Exposure to mycotoxins can happen by eating contaminated foods or from animals that are fed contaminated feed. Since temperature and humidity are important parameters for the growth of fungi, climate change is anticipated to impact on the presence of mycotoxins.

EFSA collects and evaluates occurrence data on mycotoxins in food and feed. EFSA provides risk managers with scientific advice to inform their decision-making on the setting of maximum levels of mycotoxins in food and feed. It looks at the related risks posed to human and animal health and may set Tolerable Daily Intakes for various mycotoxins.

EFSA’s designed experts assess human and animal exposure using occurrence data, including exposure for specific population groups and for different animal species (such as farm animals, fish and pets). EFSA ensures the continuity of data collection on mycotoxins, integrating newly generated occurrence data into existing databases and supporting the creation of new ones.” Source: EFSA.

After EFSA risk assessment (which normally take about two years) is concluded, EU legislation is stipulated to make that food or feed, containing a level of mycotoxins unacceptable from a public health viewpoint, is not placed on the market. Since mycotoxins are naturally occurring, impose a total ban will be impossible. Instead, the EU protects human and animal health by ensuring that mycotoxins are kept at levels which are as low as possible (according to the ALARA (As Low As Reasonably Achievable) principle), determined on the basis of sound scientific evidence (by EFSA), and following a range of good agricultural practices during the handling, storage, processing and distribution of cereals and oilseeds.

During the legislative proposal process, relevant experts from EU member states are consulted by the EU Commission in dedicated meetings, such as “The Standing Committee on the Food Chain and Animal Health”. During this process, also relevant stakeholders are consulted - in public or targeted consultations - to check if the proposed regulatory levels are feasible in practice and to check the economic impact.

Once the new regulatory levels are in place (after having being published in EU legal acts: regulations, directives, decisions, recommendations and opinions), all actors in the value chain have to comply, and from the date of enforcement, food and feed exceeding maximum levels cannot be placed in the market anymore (although normally a 6 months transition period is granted).

Sometimes, indicative levels are instead established (with a Commission monitoring Recommendation) for a certain mycotoxin in food. These levels should not affect the possibility to place on the market any food, but investigations should be carried out by relevant EU member States authorities, and/or Food Business Operators, when the concentration of a certain mycotoxin in food exceeds those indicative levels.

Regarding feed, guidance values can also instead be established for certain mycotoxins, in case there is no (or an imperceptible) transfer of such mycotoxins into food of animal origin, hence not leading to any significant harm for consumers.

Member State authorities are responsible for sampling food products, to ensure that they comply with the EU legislation. For imported foodstuffs, the country of origin is responsible for compliance with EU legislation, and this is controlled at EU borders.

Member States must report to EFSA the occurrence data that they have collected on mycotoxins. Stakeholders can also submit occurrence data to EFSA each year, within the Annual call for continuous collection of chemical contaminants occurrence data in food and feed, provided such data should be supplied in line with EFSA's reporting requirements.

COCERAL has first carried out a survey among its members regarding mycotoxin management in 2007. The survey was repeated in 2009, 2011, 2013, 2015, 2017, 2019, 2021 and latest in 2023. Over the time, some questions have been adapted or added to the survey but 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, oilseeds, pulses, olive oil, oils and fats, animal feed, 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 2023 survey that advise farmers inform about practices aimed at minimising mycotoxin development in the field, for example by recommending fusarium resistant seeds or adapted fungicides treatments or generally by advising farmers on good agricultural practices (tillage, crop rotations etc). Further to the advice provided, mycotoxin risk management of farmers always improves.

The second section of the survey aims at sampling and testing practices pursued by grain collectors and international traders. They intervene mostly after the grain is harvested. Collectors mainly test at harvest, in store but also at loading before transport or at delivery to first processing industry (testing before harvest is done only to a minor extent). When importing and trading within the EU, testing tends to take place more frequently at loading before transport (e.g. loading of trucks/vessels/barges, etc.) but also (to a minor extent) in store.

With more than 94% of survey participants indicating that they sample their lots to monitor mycotoxins, this highlights a continuous awareness of mycotoxin issues. Survey participants were also asked which crops they sample on which mycotoxins. From the 2023 results, maize, wheat and barley appears to be the most tested crops. Some

change in the testing patterns could be observed when comparing the replies with the 2021 survey-

Regarding the sampling methods used by operators for mycotoxins analyses, the 2023 survey shows a predominance of the use of contractual methods (such as GAFTA 124 and FOSFA) and to a minor extent to EU official control regulation sampling plans the CEN method EN/ISO 24333:2009. The majority of our members also declared to adopt the aflatoxins protocol by [EFISC-GTP](#) (as they are certified according to this food and/or feed safety management scheme).

When carrying out mycotoxin analysis internally, operators use mostly bandage kits, o such as E.L.I.S.A. (enzyme-linked immunosorbent assay) semi-quantitative and quantitative tests. When rapid analysis is required, most collectors and traders also 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. Most external laboratories used by our members are accredited according to the international standard ISO/IEC 17025:2017. Most tests carried out for our members by external laboratories is done by High-performance liquid chromatography (HPLC).

The third section of the survey aims at evaluating the impact of controls received by our members in the framework of the official regulation for mycotoxins in foodstuffs. Most of our members that received an official control, in the framework of the official control regulation for mycotoxins in foodstuffs, experienced delays in reporting by the relevant Official control authority. This makes it more difficult to take corrective measures for the respective batch.

The fourth, and last, section of the survey is a novelty since previous editions, and aims to understand the point of view of grain collectors and international traders in:

- The measures they take to prevent and mitigate mycotoxins risks in operations, and the ones asked by their customers
- The measures their suppliers declare to prevent and mitigate mycotoxins risks in the field
- Estimating which mycotoxins might become more prevalent in the future (next 10 years) in the country/ies where grains and oilseeds are sourced, also in relationship with effect of climate change
- The constraints experienced or expected when new regulatory levels for mycotoxins are going to be proposed/voted in the European Union.

Regarding this new section, most of our members expect that the following mycotoxins might become more prevalent in the future (next 10 years) in the country/ies they collect/source grains and oilseeds, also in relationship with effect of climate change (most frequently observed effect are increasingly common heat waves, especially in southeastern Europe):

- Aflatoxins and ochratoxins in corn
- Deoxynivalenol, sum of T-2 and H-T2 toxins in all cereals
- Zearalenone and Alternaria toxins in oilseeds
- A growing concern on the rise is from *Tilletia* spp (agent of karnal blunt) and rust fungi.

Another possible expected future constraint flagged by our members is that an increasing % of grains (fit for human consumption) will have to be declassified as feed, as EU regulatory levels for mycotoxins in food will likely not be met due to an increase in prevalence and co-occurrence of different mycotoxins.

An increased prevalence and occurrence of mycotoxins will lead to unpredictable food and feed safety issues, and huge economic repercussions for our members (increased sampling, testing, recalls, rejections etc.), leading ultimately to changes in food and feed security patterns at EU and international level.

Our members will do the most to make sure that such constraints will be contained by:

- Recommending farmers to
 - Performing meteorological survey during critical stages of the crops (i.e., flowering)
 - Use only certified seed material
 - Use better crop rotation practices
 - Use of allowed fungicides at the right dose and right time (i.e. when the weather impose it)
- Harvest the grains when they are ready and dry and cool the grains slowly and gently in storage
- Use good storage practices (cooling, ventilation) to avoid storage mycotoxins to occur
- Use of contract specifications (purchase and sale) and internal monitoring programs
- Perform (even more) sampling and testing at all stages (with focus at collection and pre-shipment), always using skilled personnel (i.e., surveyors) and accredited laboratories when using confirmatory test methods such as HPLC, LC-MS-MS.

On the other hands, new tools should be soon made available for collectors and traders to assess mycotoxins occurrence in grains and oilseeds better and faster (at this moment there is a lack of reliable quick tests for certain mycotoxins such as ergot alkaloids).

More cooperation with EFSA, FAO and the scientific community is also sought by our members, especially regarding the forecast models to understand how climate change and mycotoxins prevalence and co-occurrence are related.

REGULATORY FRAMEWORK

Food

The Commission Regulation (EU) 2023/915 of 25 April 2023 on maximum levels for certain contaminants in food (and repealing Regulation (EC) No 1881/2006) sets maximum levels for certain contaminants in foodstuffs, amongst others for mycotoxins.

Feed

Commission Directive 2002/32/EC on undesirable substance in animal feed foresees maximum levels for aflatoxin B1 and rye ergot (*Claviceps purpurea*). Recommended guidance values for different mycotoxins 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 toxins, and fumonisins in products intended for animal feeding.

Maximum levels for mycotoxins in food and feed

The table 1 here below summarizes the limits and guidance values for food and feed.

Table 1: Summary of CURRENT regulatory levels for mycotoxins in food and feed

Mycotoxins		Food	Regulatory level	Legal reference	Feed	Regulatory level	Legal reference
Storage mycotoxins	Aflatoxin B₁	Cereals <i>(Including processed cereal products. Products derived from cereals relate to products containing at least 80 % cereal products)</i>	2.0 (Maximum level in µg/kg (ppb))	1	Cereals	0.02 (Maximum content in mg/kg (ppm) relative to a feed with a moisture content of 12%)	2
		Maize and rice <i>(to be subjected to sorting or other physical treatment before placing on the market for the final consumer or use as an ingredient in food)</i>	4.0 (Maximum level in µg/kg (ppb))				
	Aflatoxin (Sum of B₁, B₂, G₁, and G₂)	Cereals <i>(Including processed cereal products. Products derived from cereals relate to products containing at least 80 % cereal products)</i>	4.0 (Maximum level in µg/kg (ppb))				
		Maize and rice <i>(to be subjected to sorting or other physical treatment before placing on the market for the final consumer or use as an ingredient in food)</i>	10.0 (Maximum level in µg/kg (ppb))				
	Ochratoxin A	Unprocessed cereal grains	5.0 (Maximum level in µg/kg (ppb)) ³		Cereals and cereal products	0.25 (Guidance value in mg/kg (ppm) relative to a feed with a moisture content of 12 %)	4
		Products derived from unprocessed cereal grains and cereals placed on the market for the final consumer <i>(Including processed cereal products. Products derived from cereals relate to products containing at least 80 % cereal products)</i>	3.0 (Maximum level in µg/kg (ppb))				
		Sunflower seeds, hempseeds, soybeans	5.0 (Maximum level in µg/kg (ppb))				

¹ Commission Regulation (EU) 2023/915 of 25 April 2023 on maximum levels for certain contaminants in food (and repealing Regulation (EC) No 1881/2006)

² Directive 2002/32/EC

³ The maximum level applies to unprocessed cereal grains placed on the market before first-stage processing

⁴ Commission Recommendation (EC) 2006/576

Mycotoxins		Food	Regulatory level	Legal reference	Feed	Regulatory level	Legal reference
Field mycotoxins	Deoxynivalenol	Unprocessed cereal grains <i>(except rice)</i>	1000 (Maximum level in µg/kg (ppb)) ⁵	6	Cereals and cereal products	8 (Guidance value in mg/kg (ppm) relative to a feed with a moisture content of 12 %)	7
		Unprocessed durum wheat grains	1500 (Maximum level in µg/kg (ppb)) ⁸				
		Unprocessed oat grains with husk	1750 (Maximum level in µg/kg (ppb)) ⁹				
		Cereals placed on the market for the final consumer <i>(except rice and rice products)</i>	750 (Maximum level in µg/kg (ppb)) ¹⁰				
		Unprocessed maize grains <i>(Except unprocessed maize grains for which it is evident e.g. through labelling or destination, that they are intended for use in a wet milling process only (starch production))</i>	1500 (Maximum level in µg/kg (ppb)) ¹¹				
	Zearalenone	Unprocessed cereal grains <i>(except rice)</i>	100 (Maximum level in µg/kg (ppb)) ¹²	13	Cereals and cereal products	2 (Guidance value in mg/kg (ppm) relative to a feed with a moisture content of 12 %)	
		Cereals placed on the market for the final consumer <i>(except rice and rice products)</i>	75 (Maximum level in µg/kg (ppb))				

⁵ The maximum level applies to unprocessed cereal grains placed on the market before first-stage processing

⁶ Commission Regulation (EU) 2024/1022 of 8 April 2024 amending Regulation (EU) 2023/915 as regards maximum levels of deoxynivalenol in food

⁷ Commission Recommendation (EC) 2006/576

⁸ The maximum level applies to unprocessed cereal grains placed on the market before first-stage processing

⁹ The maximum level applies to unprocessed cereal grains placed on the market before first-stage processing

¹⁰ The maximum level applies to unprocessed cereal grains placed on the market before first-stage processing

¹¹ The maximum level applies to unprocessed cereal grains placed on the market before first-stage processing

¹² The maximum level applies to unprocessed cereal grains placed on the market before first-stage processing

¹³ Commission Regulation (EU) 2023/915 of 25 April 2023 on maximum levels for certain contaminants in food (and repealing Regulation (EC) No 1881/2006)

Mycotoxins		Food	Regulatory level	Legal reference	Feed	Regulatory level	Legal reference	
Field mycotoxins	Zearalenone	Unprocessed maize grains <i>(Except unprocessed maize grains for which it is evident e.g. through labelling or destination, that they are intended for use in a wet milling process only (starch production))</i>	350 (Maximum level in µg/kg (ppb)) ¹⁴	15	Maize by-products	3 (Guidance value in mg/kg (ppm) relative to a feed with a moisture content of 12 %)	16	
		Maize placed on the market for the final consumer	100 (Maximum level in µg/kg (ppb))					
	Fumonisin (sum of B ₁ and B ₂)	Unprocessed maize grains <i>(Except unprocessed maize grains for which it is evident e.g. through labelling or destination, that they are intended for use in a wet milling process only (starch production))</i>	4000 (Maximum level in µg/kg (ppb)) ¹⁷		100 (Maximum level in µg/kg (ppb))	Maize and maize products		60 (Guidance value in mg/kg (ppm) relative to a feed with a moisture content of 12 %)
		Maize placed on the market for the final consumer						
	Ergot sclerotia	Unprocessed cereal grains (Except maize and rice)	0.2 (Maximum level in g/kg)		0.5 (0.2 as of 1 July 2025) (Maximum level in g/kg)	Feed materials and compound feed containing unground cereals	1000 (Maximum content in mg/kg (ppm) relative to a feed with a moisture content of 12 %)	18
		Unprocessed rye grains						

¹⁴ The maximum level applies to unprocessed cereal grains placed on the market before first-stage processing

¹⁵ Commission Regulation (EU) 2023/915 of 25 April 2023 on maximum levels for certain contaminants in food (and repealing Regulation (EC) No 1881/2006)

¹⁶ Commission Recommendation (EC) 2006/576

¹⁷ The maximum level applies to unprocessed cereal grains placed on the market before first-stage processing

¹⁸ Directive 2002/32/EC

Mycotoxins		Food	Regulatory level	Legal reference	Feed	Regulatory level	Legal reference
Field mycotoxins	Ergot alkaloids ¹⁹	Milling products of barley, spelt and oats (with an ash content lower than 900mg/100g dry matter)	50 (Maximum level in µg/kg (ppb))	20			
		Milling products of wheat (with an ash content lower than 900mg/100g dry matter)	100 (50 as from 1 July 2028) (Maximum level in µg/kg (ppb))				
		Milling products of barley, wheat, spelt and oats (with an ash content equal or higher than 900mg/100g dry matter) Barley, wheat, spelt and oats grains placed on the market for the final consumer	150 (Maximum level in µg/kg (ppb))				
		Rye milling products Rye placed on the market for the final consumer	500 (250 as from 1 July 2028) (Maximum level in µg/kg (ppb))				
	Sum of T-2 and HT-2 Toxins	Unprocessed malting barley grains	200 (Maximum level ²¹ in µg/kg (ppb))	22	Other cereal products	500 (Indicative level in mg/kg (ppm) relative to a feed with a moisture content of 12 %)	23
		Unprocessed barley grains other than malting barley grains	150 (Maximum level ²⁴ in µg/kg (ppb))				

¹⁹ Lower bound sum of ergocornine/ergocorninine; ergocristine/ergocristinine; ergocryptine/ergocryptinine (α- and β-form); ergometrine/ergometrinine; ergosine/ergosinine; ergotamine/ergotaminine

²⁰ Commission Regulation (EU) 2023/915 of 25 April 2023 on maximum levels for certain contaminants in food (and repealing Regulation (EC) No 1881/2006)

²¹ The maximum level applies to unprocessed malting barley grains placed on the market for first-stage processing

²² Commission Regulation (EU) 2024/1038 of 9 April 2024 amending Regulation (EU) 2023/915 as regards maximum levels of T-2 and HT-2 toxins in food

²³ Commission Recommendation of 27 March 2013 on the presence of T-2 and HT-2 toxin in cereals and cereal products

²⁴ The maximum level applies to unprocessed barley grains placed on the market for first-stage processing

Mycotoxins		Food	Regulatory level	Legal reference	Feed	Regulatory level	Legal reference
Field mycotoxins	Sum of T-2 and HT-2 Toxins	Unprocessed oat grains with inedible husk	1250 (Maximum level ²⁵ in µg/kg (ppb))	26	Oat milling products (husks)	2000 (Indicative level in mg/kg (ppm) relative to a feed with a moisture content of 12 %)	27
		Unprocessed durum wheat grains	100 (Maximum level ²⁸ in µg/kg (ppb))		Other cereal products	500 (Indicative level in mg/kg (ppm) relative to a feed with a moisture content of 12 %)	
		Unprocessed maize grains (Except unprocessed maize grains for which it is evident, e.g. through labelling or destination, that they are intended for use in a wet milling process only (starch production))	100 (Maximum level ²⁹ in µg/kg (ppb))				
		Unprocessed other cereals (Rye) (except rice)	50 (Maximum level ³⁰ in µg/kg (ppb))				

²⁵ The maximum level applies to unprocessed oat grains with husk placed on the market for first-stage processing; The maximum level applies to the oat grains with the inedible husk included

²⁶ Commission Regulation (EU) 2024/1038 of 9 April 2024 amending Regulation (EU) 2023/915 as regards maximum levels of T-2 and HT-2 toxins in food

²⁷ Commission Recommendation of 27 March 2013 on the presence of T-2 and HT-2 toxin in cereals and cereal products

²⁸ The maximum level applies to unprocessed durum wheat grains placed on the market for first-stage processing

²⁹ The maximum level applies to unprocessed maize grains placed on the market for first-stage processing

³⁰ The maximum level applies to unprocessed cereal grains placed on the market for first-stage processing

Mycotoxins		Food	Regulatory level	Legal reference	Feed	Regulatory level	Legal reference
Field mycotoxins	Sum of T-2 and HT-2 Toxins	Oats placed on the market for the final consumer	100 (Maximum level in µg/kg (ppb))	31	Oat milling products (husks)	2000 (Indicative level in mg/kg (ppm) relative to a feed with a moisture content of 12 %)	32
		Cereals placed on the market for the final consumer (except rice)	20 (Maximum level in µg/kg (ppb))		Other cereal products	500 (Indicative level in mg/kg (ppm) relative to a feed with a moisture content of 12 %)	
		Barley, maize and durum wheat placed on the market for the final consumer	50 (Maximum level in µg/kg (ppb))				

³¹ Commission Regulation (EU) 2024/1038 of 9 April 2024 amending Regulation (EU) 2023/915 as regards maximum levels of T-2 and HT-2 toxins in food

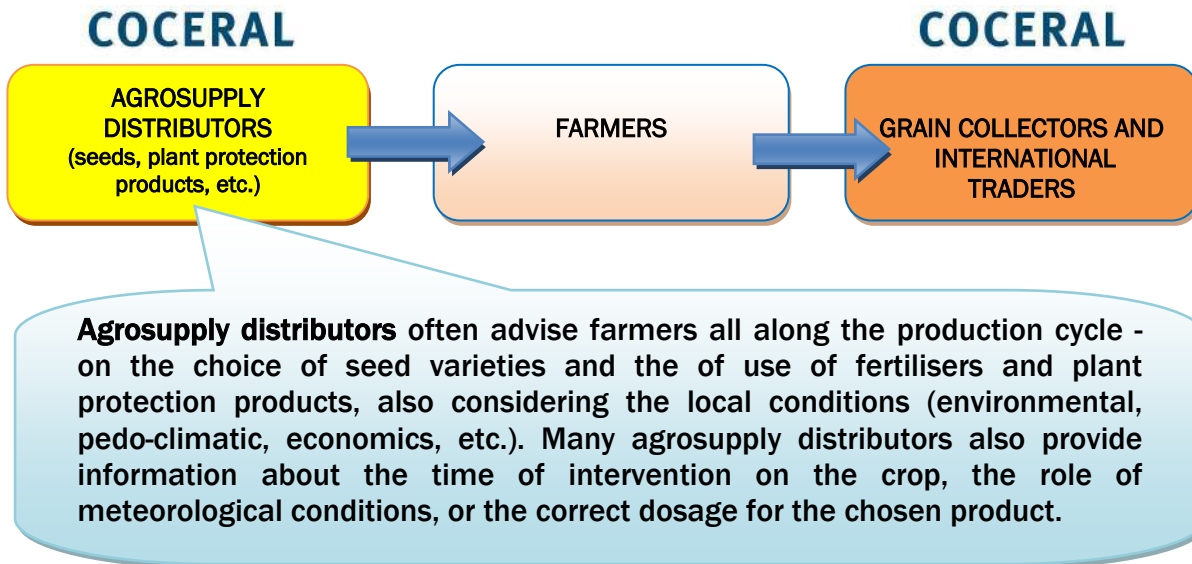
³² Commission Recommendation of 27 March 2013 on the presence of T-2 and HT-2 toxin in cereals and cereal products

Table of Contents

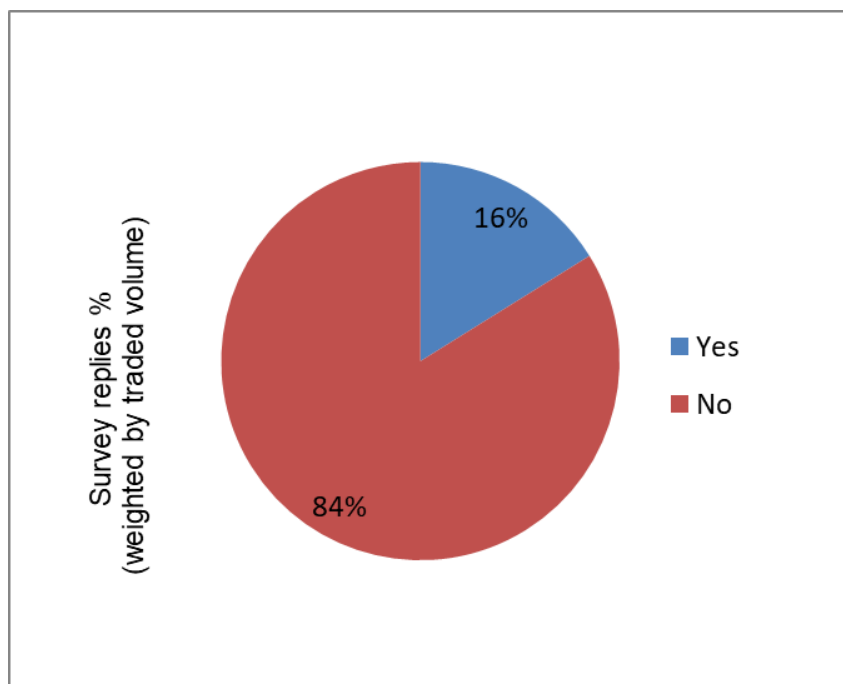
1	Minimising risks posed by mycotoxins in the field	16
1.1	Do you specifically advise farmers on mycotoxins management?	16
1.2	How do you manage risks of mycotoxins in the field?	17
1.3	When advising farmers, what kind of approach to manage mycotoxins are you using?	18
1.3.1	In case you apply the Forecast Model, by whom has it been proposed?	18
1.4	After advising farmers, the management of mycotoxins risk improves, stagnates or becomes worse?	19
2	Sampling, analysis and detection of mycotoxins	20
2.1	Do you carry out sampling in your lots for the detection of mycotoxins?	20
2.1.1	If YES, which mycotoxin/s are you analysing and in which crop/s?	21
2.2	Which sampling method/s is/are used by your company for mycotoxins analyses?	23
2.3	According to your activities, when do you test your lots for mycotoxins?	24
2.4	Which frequency of testing are you applying? (multiple answers possible)	25
2.5	Do you carry out visual tests?	26
2.6	Do you carry out your own mycotoxins analysis at your company?	26
2.6.1	If you carry out mycotoxin analysis at your company, which kind of method of rapid test do you use?	27
2.7	Do you carry out analysis to evaluate the presence of mycotoxins by external laboratories?	28
2.7.1	If you carry out external analysis for the mycotoxin monitoring, what is the purpose?	28
2.7.2	If you carry out external analysis for the mycotoxin monitoring, what is the methodology used by the laboratory?	20
2.8	Is your testing laboratory accredited in accordance with the international standard ISO/IEC 17025?	30
3	Regulation enforcement and controls	31
3.1	Have you been already controlled in the framework of the official regulation for mycotoxins in foodstuffs?	31
3.2	Apart from exceeding regulatory limits, did you have to conduct a product recall?	32
4	General open questions	33
4.1	Please list which measures you take to prevent and mitigate mycotoxins risks in your business, and which ones are asked by your customers	33
4.2	Please list which measures your suppliers declare to prevent and mitigate mycotoxins risks in the field	33
4.3	Please estimate which mycotoxins might become more prevalent in the future (next 10 years) in the country/ies you source your grains and oilseeds, also in relationship with effect of climate change	34
4.4	Which constraints have you experienced, or do you expect when new regulatory levels for mycotoxins are going to be proposed/voted in the EU?	34
	ANNEX 1: QUESTIONNAIRE “MYCOTOXIN MANAGEMENT” 2023	35
	ANNEX 2: METHOD FOR REPLIES PROCESSING	41

1 Minimising risks posed by mycotoxins in the field

This section refers to the agrosupply distributors, members of COCERAL.

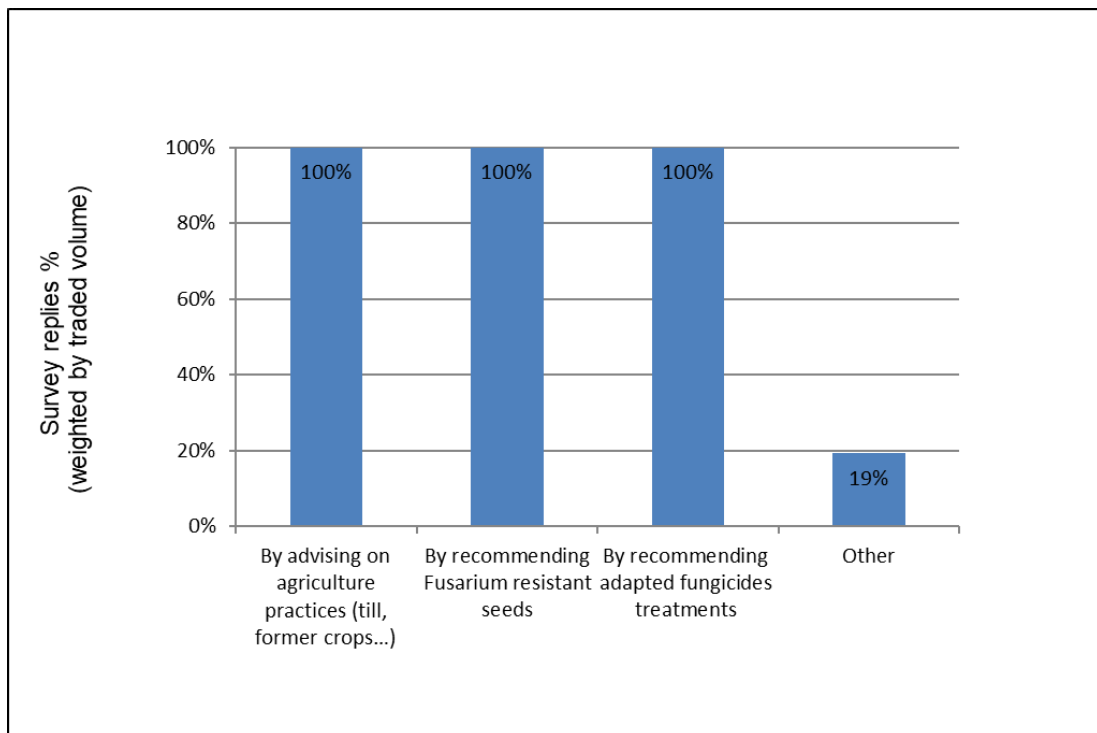


1.1 Do you specifically advise farmers on mycotoxins management?



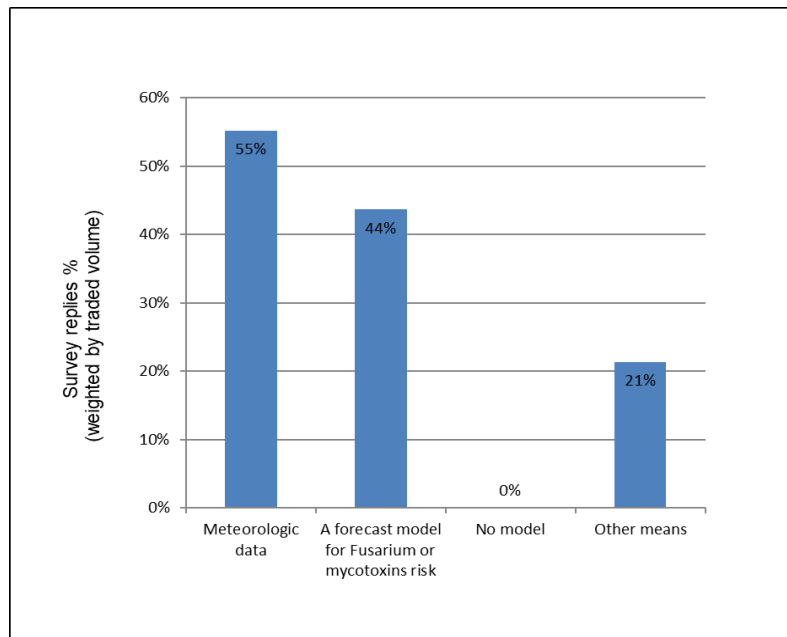
16% of the participants to the survey are agrosupply distributors, advising farmers on practices aimed at minimising the risk of mycotoxin development in the fields. This highlights that mycotoxin management is still a key concern for COCERAL agrosupply members, and that operators use their role to support farmers in managing mycotoxins development in field.

1.2 How do you manage risks of mycotoxins in the field?



When advising farmers regarding mycotoxins, agrosupply distributors recommend them to adopt best agricultural practices, use specific fungicide treatments, as well as use *Fusarium spp* resistant seeds.

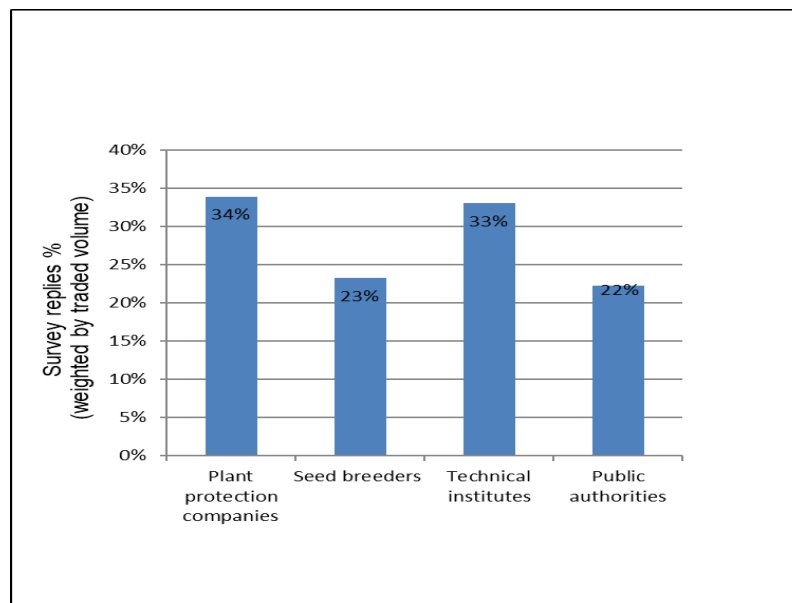
1.3 When advising farmers, what kind of approach to manage mycotoxins are you using?



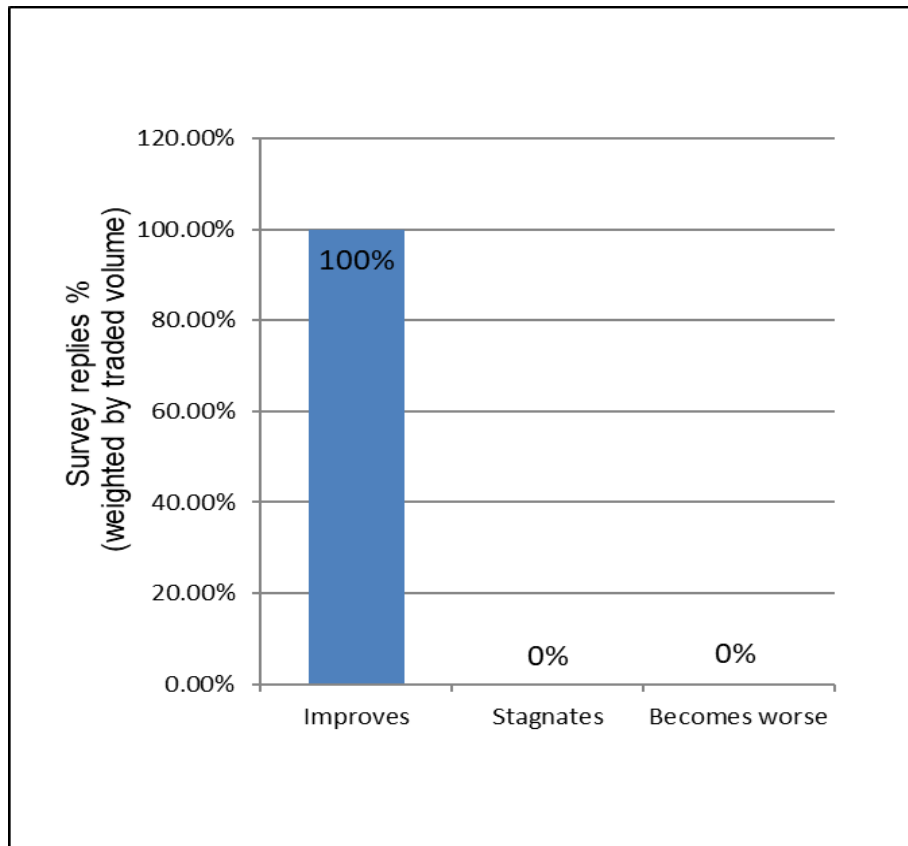
The dominant models agrosupply distributors use when advising farmers seem to be Meteorological data still to be. Forecast models for fusarium or mycotoxin risk are still used by a large part of them. Some also use other means such as observation or provide online tools.

If the forecast model is used, this is still normally proposed by plant protection companies or technical institutes (see graph below). However, compared to the 2021 survey results, the role of public authorities have considerably increased (22% in 2023 against 4% in 2021).

1.3.1 In case you apply the Forecast Model, by whom has it been proposed?



1.4 After advising farmers, the management of mycotoxins risk improves, stagnates or becomes worse?

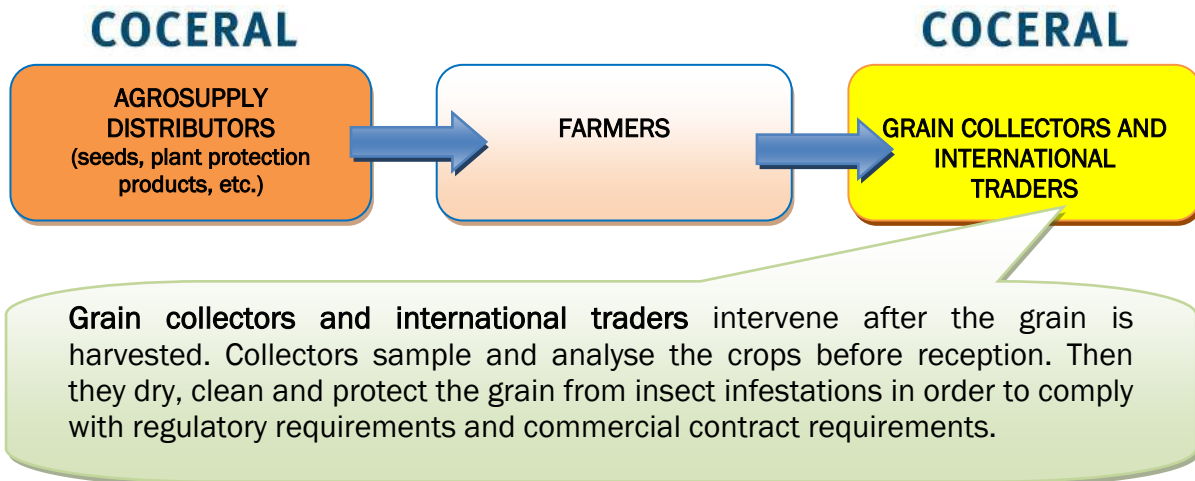


All agrosupply distributors advising farmers on agricultural practices observe an improvement of the mycotoxin risk management of farmers (100%). The level confirms the same trend when compared to 2021.

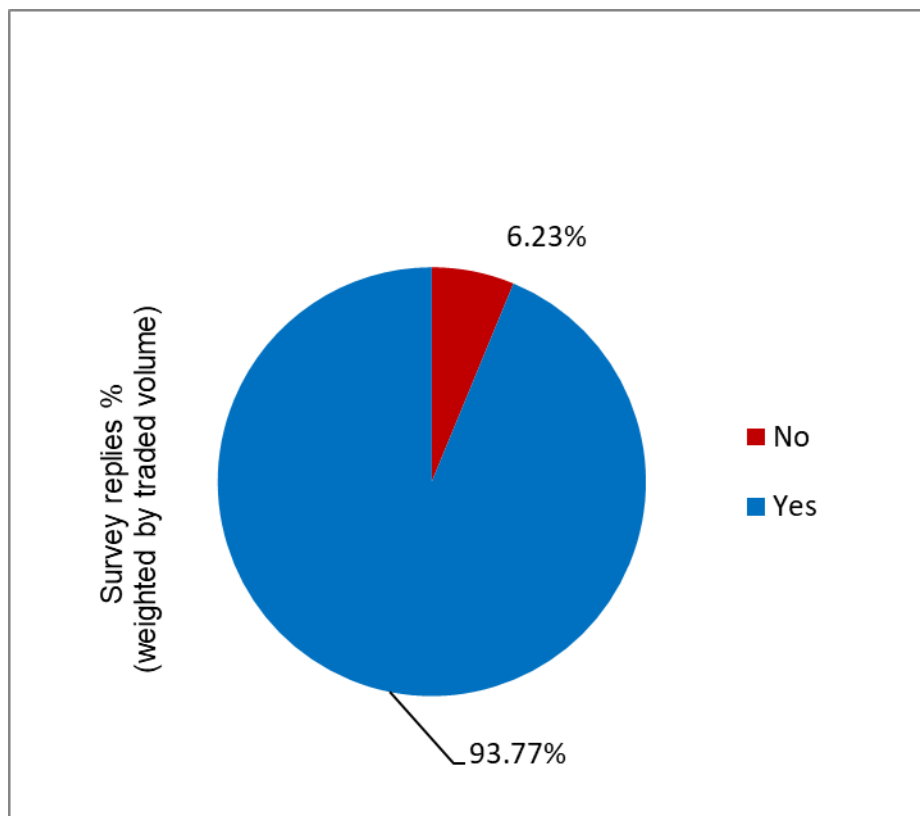
By further enhancing the collaboration between the principal actors involved and gathering more knowledge concerning the mycotoxins and their prevention, distributors continuously aim to improve the situation.

2 Sampling, analysis and detection of mycotoxins

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

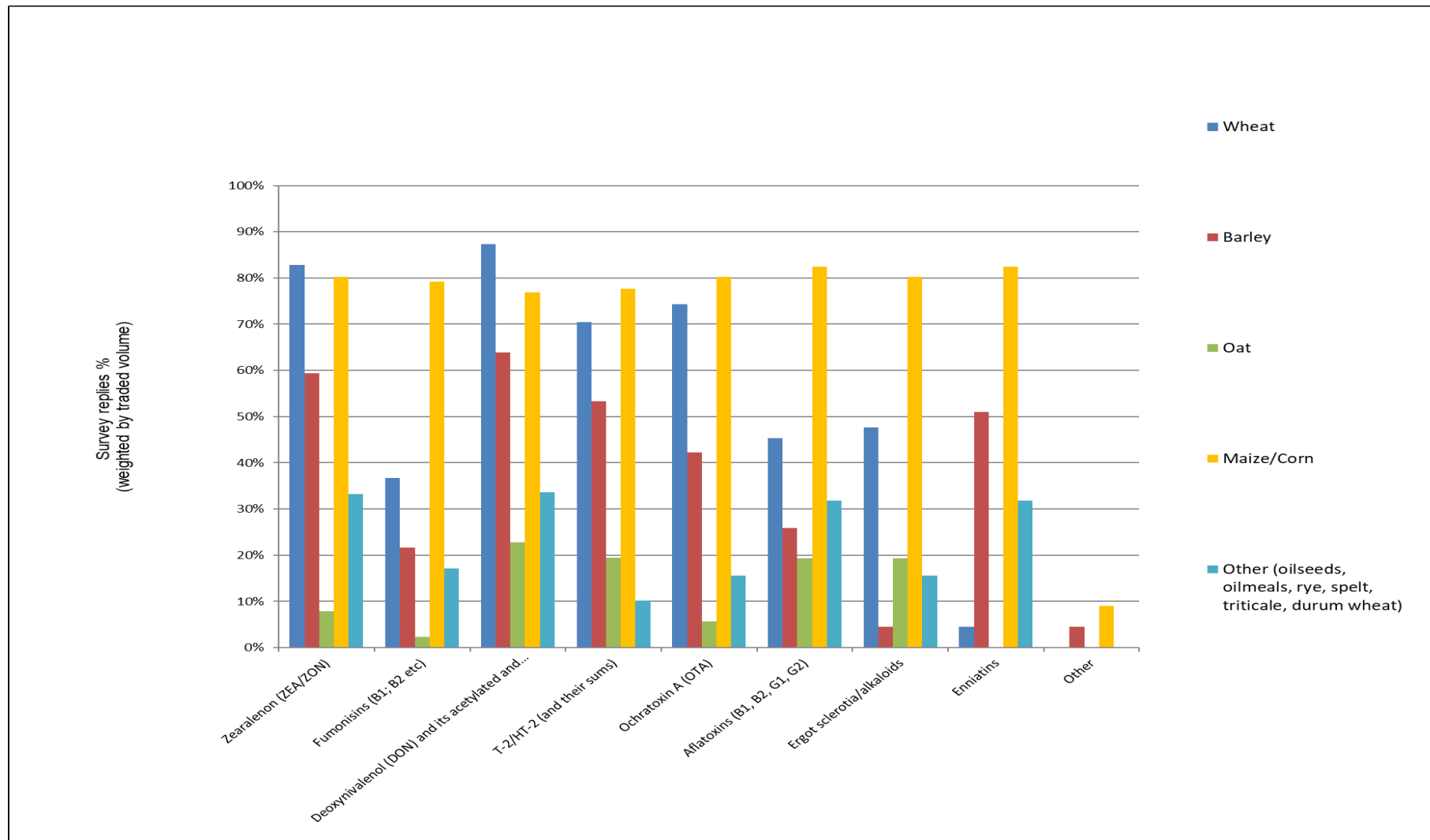


2.1 Do you carry out sampling in your lots for the detection of mycotoxins?



This graph confirms the trend in growing awareness and extent of the level of monitoring that operators put in place for mycotoxin detection: more than 94% of the respondents to the survey indicated that they carry out mycotoxin sampling operations on their lots.

2.1.1 If YES, which mycotoxin/s are you analysing and in which crop/s?



The chart at page 15 indicates the level of testing of different crops regarding the different mycotoxins.

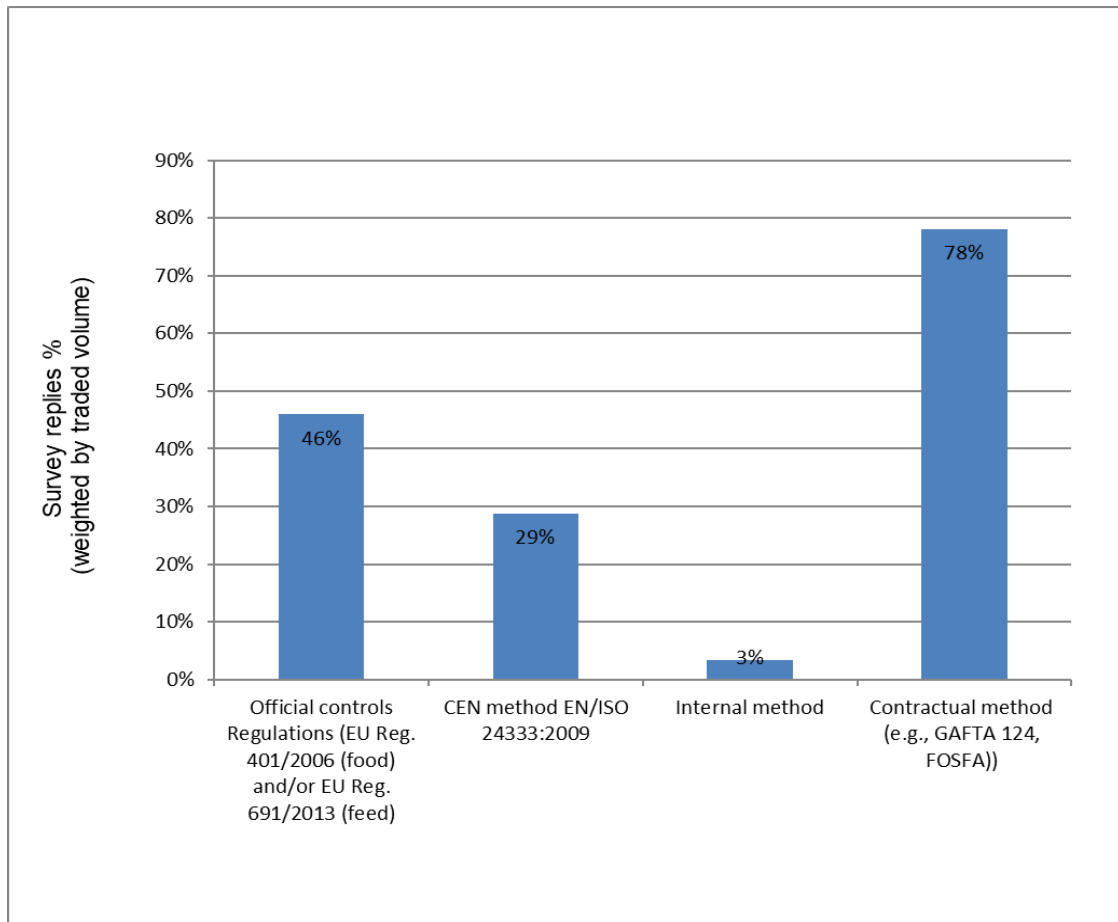
Maize, wheat and barley appears to be the most tested crops, with Zearalenone, Deoxynivalenol, Ochratoxin A and Aflatoxins being the mycotoxins tested by the largest number of operators. About 80% of the participating operators tested **maize** also on ergot sclerotia and/or alkaloids and Enniatins, while 50% of the participating operators tested also other crops (i.e., rye, triticale, spelt) for ergot sclerotia and/or alkaloids. Data on **maize** also indicates that ergot sclerotia and/or alkaloids testing is performed more on this crop than on wheat and barley.

The survey findings suggest that other crops (oilseeds, rye, spelt, triticale, durum wheat) are less frequently tested on mycotoxins than wheat, maize, barley, and oat.

In comparison to survey replies in 2021, some changes in testing patterns can be observed:

- On **Zearalenone**, a reduction of the level of testing done on oat, in comparison to the 2021 report.
- **Fumonisin**s were also tested more often on wheat and barley, with test on oats remaining at the same level of 2021, while testing on maize has slightly decreased.
- Testing for **Deoxynivalenol** remains the same as in the 2021 survey,
- **testing for the sum of T-2 and HT-2 toxins has doubled since 2021, and even tripled for corn.**
- **Ochratoxin A** testing has slightly decreased since 2021 on all crops.
- Regarding **aflatoxins**, 2023 survey results show a reduction of test performed on wheat and barley, but a 50% increase of testing for other crops can be observed.
- Testing for **ergot sclerotia and/or alkaloids** remains the same as in the 2021 survey, with a slight increase for barley.
- Testing on **Enniatins** has remained the same on maize and barley (as in 2023) but a 50% increase of testing for other crops can be observed.

2.2 Which sampling method/s is/are used by your company for mycotoxins analyses?



Regarding the sampling methods used by operators for mycotoxins analyses, in 2023 we see some changes in comparison with the 2021 survey:

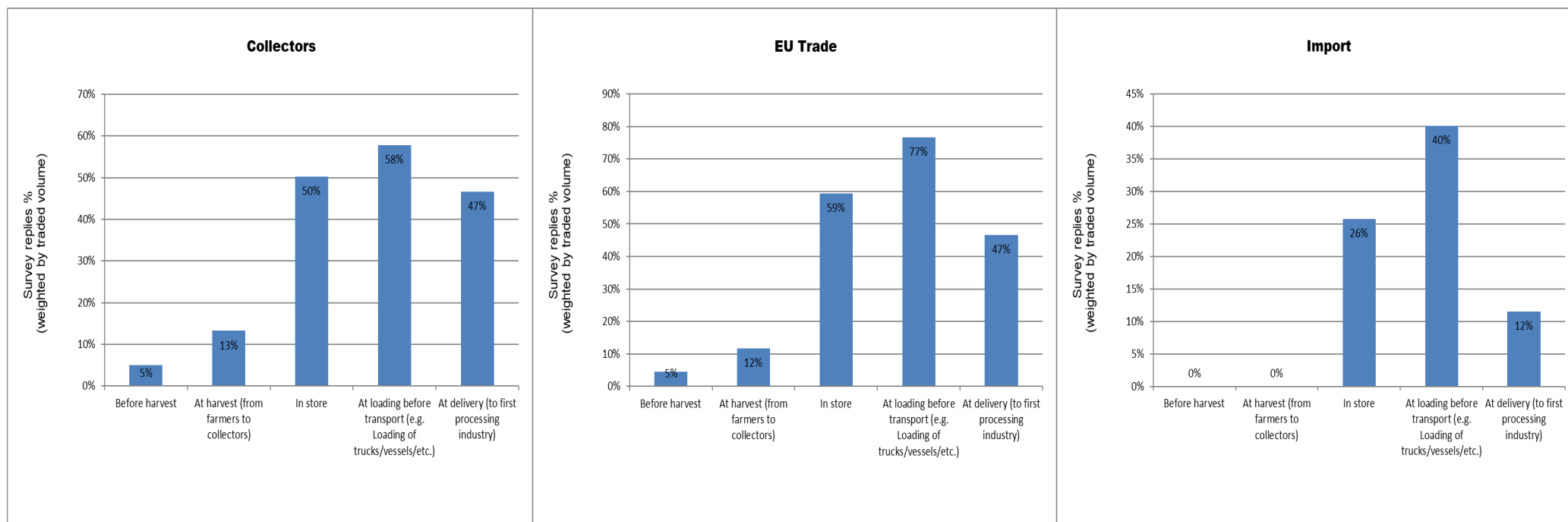
- a 50% decrease in the use of the CEN method EN/ISO 24333:2009
- a drastic reduction in the use of internal methods (from 29% to 3%)
- a three-fold increase in use of contractual methods (such as GAFTA 124).

The majority of our members also declared to adopt the aflatoxins protocol by [EFISC-GTP](#) (as they are certified according to this food and/or feed safety management scheme).

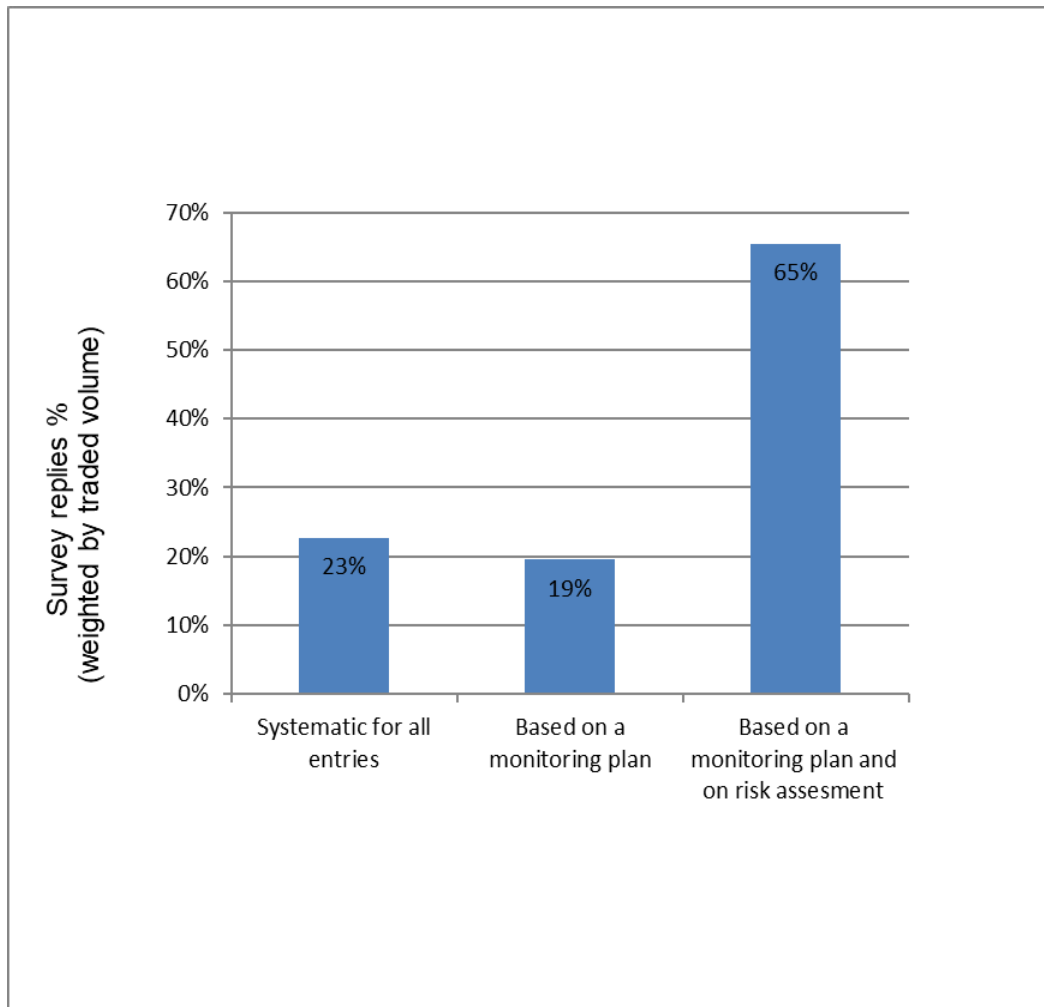
When asked about the constraints experienced in sample taking, our members provided the following answers:

- In a big transit silo, the sampling is not always feasible
- For large static lots, representative lots cannot be obtained
- Size of the sample is key
- Sampling is usually a time-consuming process and it could considerably slow down discharging/loading procedure which ultimately leads to higher costs
- Finding the qualified personnel which is skilled for sampling methods.

2.3 According to your activities, when do you test your lots for mycotoxins?

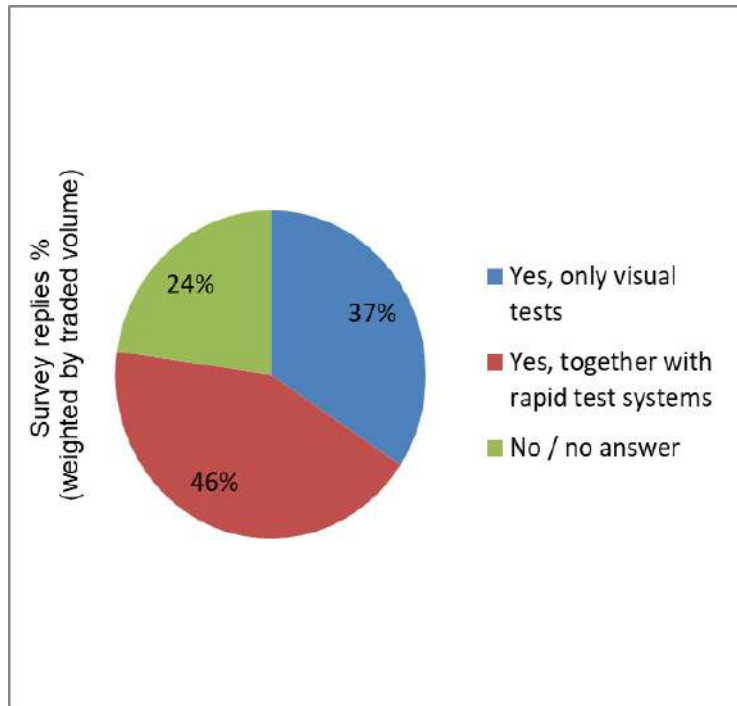


2.4 Which frequency of testing are you applying? (multiple answers possible)



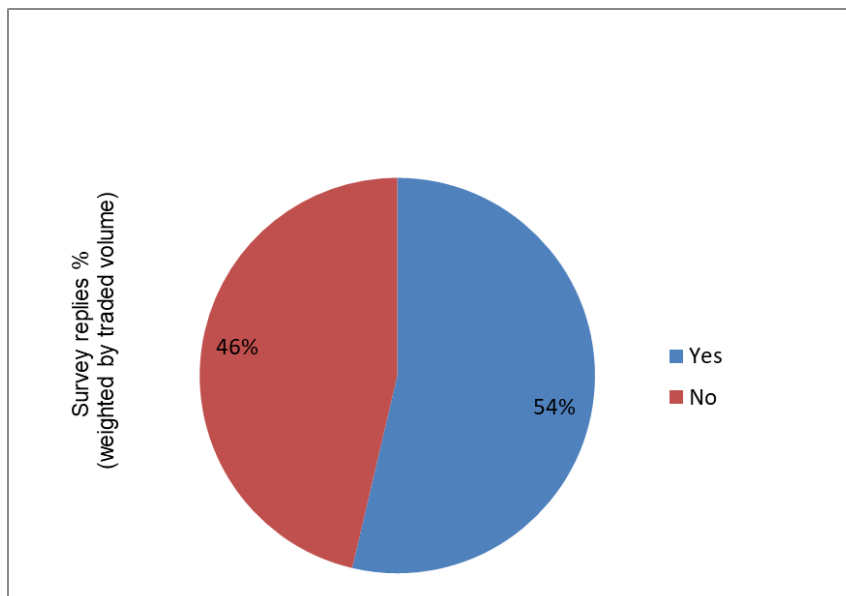
Those operators that perform mycotoxin testing normally follow a monitoring plan with a risk assessment (65%), while only 19% follow a simple monitoring plan. 23% of the operators even perform systematic testing for all entries.

2.5 Do you carry out visual tests?



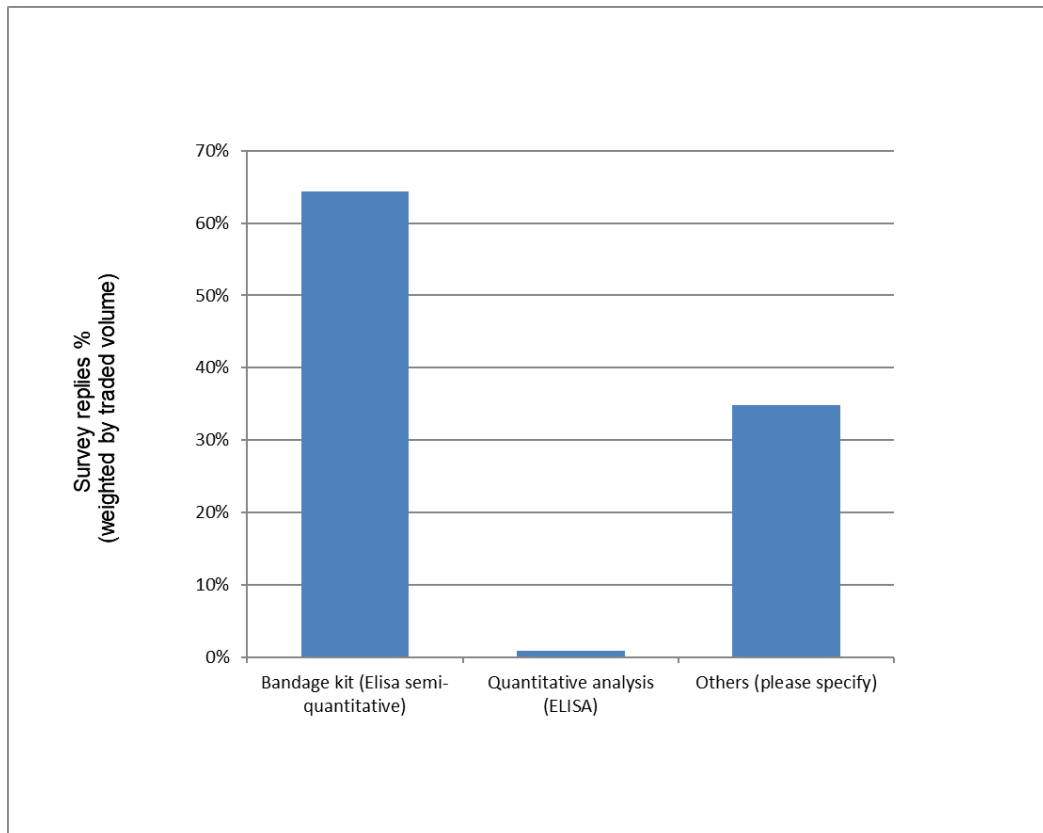
About 50% of operators carry out visual tests as a support to rapid test systems. Such practice seems less common than in the 2021 survey, where about 70 % indicated that they had done so. More members declared to have only used visual tests (37% in 2023 instead of 11% back in 2021).

2.6 Do you carry out your own mycotoxins analysis at your company?



In company own analysis are 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. The level of internal testing of mycotoxins keeps the same trend as in the 2021 survey.

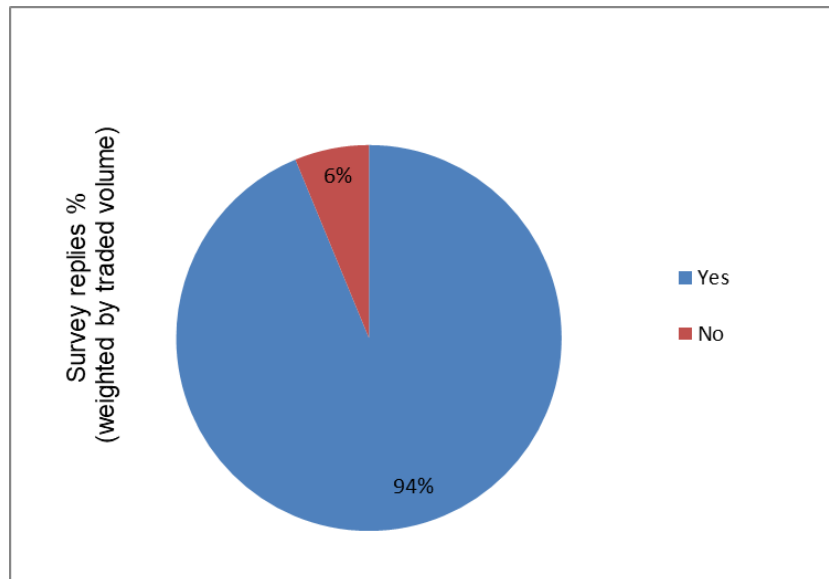
2.7.1 If you carry out mycotoxin analysis at your company, which kind of method of rapid test do you use?



The graph indicates a balanced use of bandage kits and other systems (not specified by participants to the survey). This trend was also confirmed in the 2021 report, although the use bandage kits has doubled and the use of quantitative analysis (ELISA) has almost zeroed.

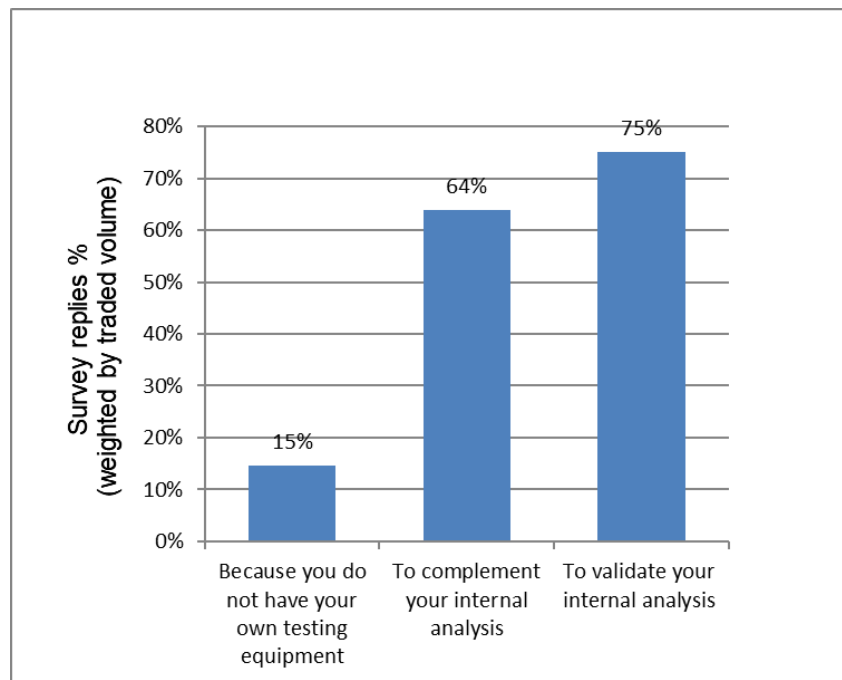
Operators declared that the main suppliers of bandage kits are still Neogen and R-Biopharm, as also confirmed in 2021 report, while the main supplier of ELISA quantitative analysis is still R-Biopharm.

2.7 Do you carry out analysis to evaluate the presence of mycotoxins by external laboratories?



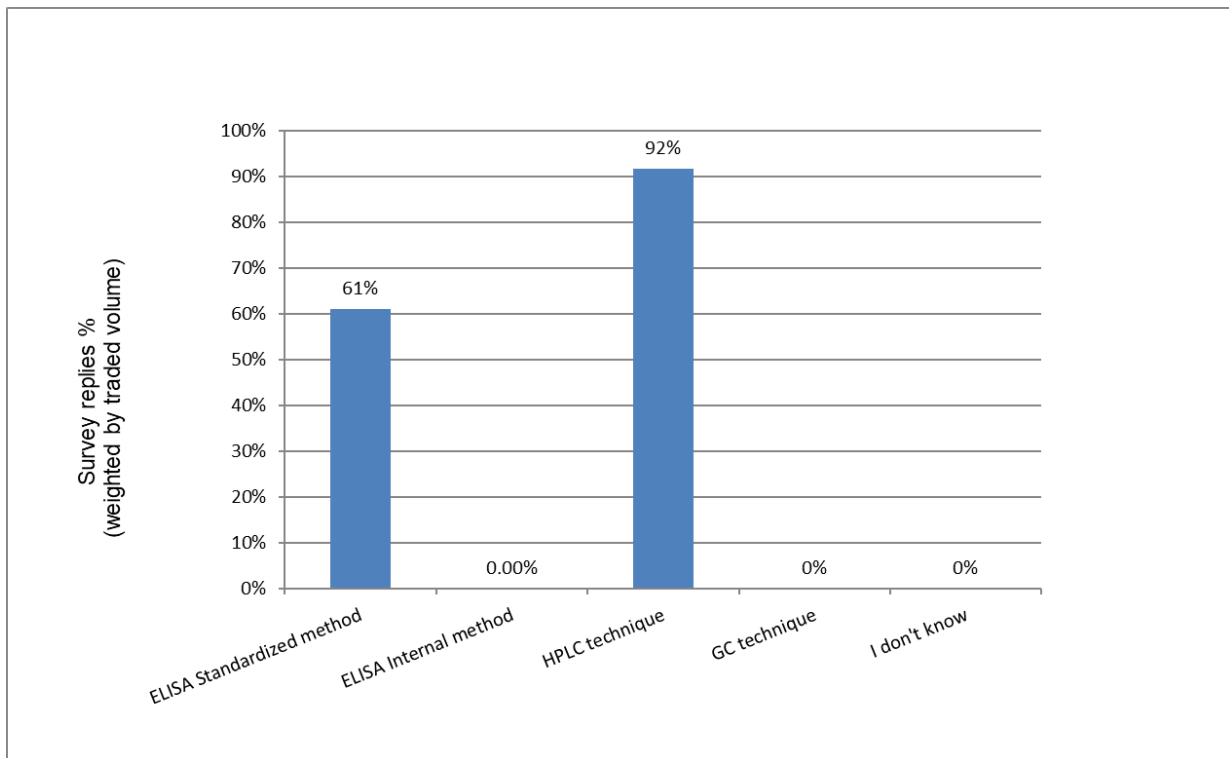
Analysis performed by external laboratories are also used to confirm the results of internal testing and/or to provide for missing data.

2.7.1 If you carry out external analysis for the mycotoxin monitoring, what is the purpose?



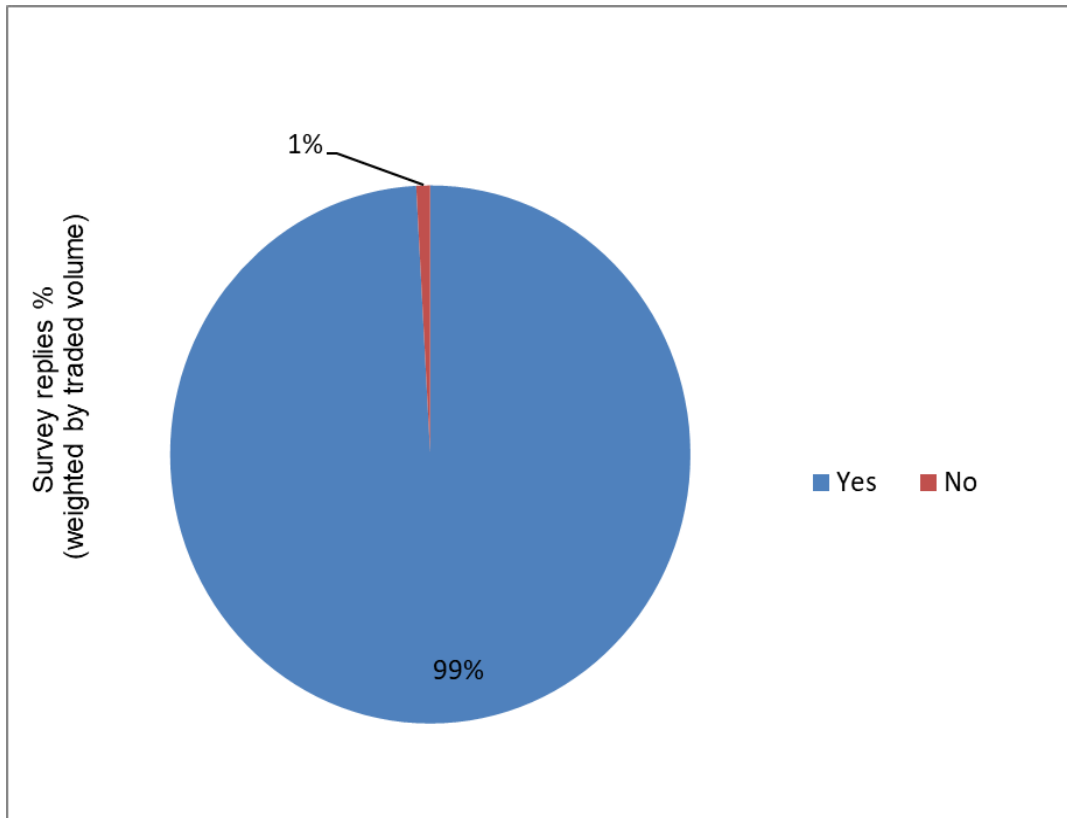
The reasons mentioned most often for asking external laboratories to do analysis are to complement and/or validate for internal analysis, with a considerable increase since last report (from 35 to 64%, and from 36 to 75%, respectively) while, to a minor extent, this is due to the lack of internal testing equipment (this has decreased from 40 to 15%).

2.7.2. If you carry out external analysis for the mycotoxin monitoring, what is the methodology used by the laboratory?



Compared to the 2021 survey, the use of ELISA (internal) methodology in external laboratories has zeroed, while the trend in use of ELISA (standardized) methodology increased (from 45 to 61%). This can also be caused by a change in type of respondents to the survey (for example, less responses from companies with own labs). HPLC seems to remain the most used technique for external analysis since 2007 (with an increase from 76% (2021 survey) to 92% in 2023); participants still declared that external laboratories are not using GC technique (as in 2021).

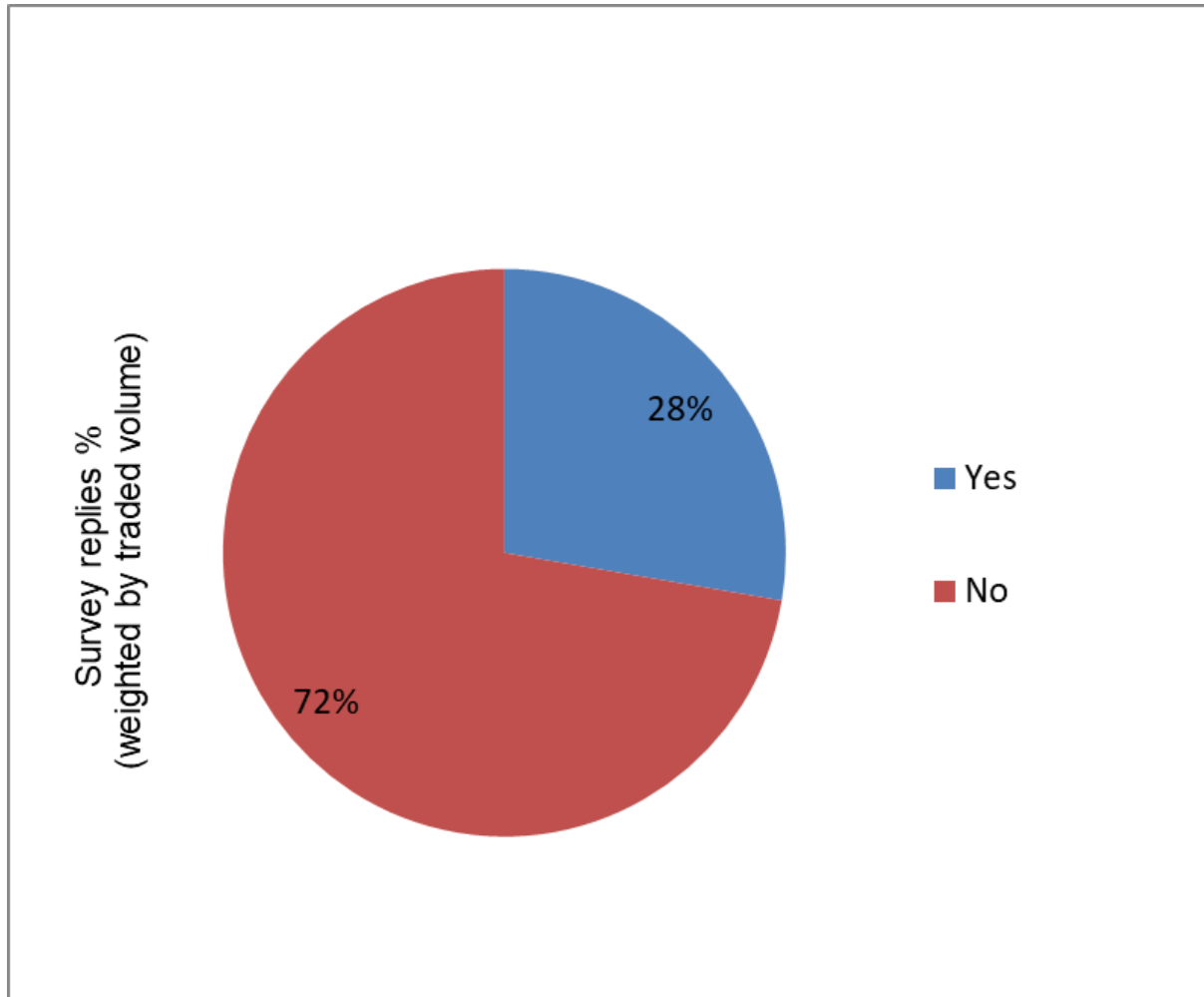
2.8 Is your testing laboratory accredited in accordance with the international standard ISO/IEC 17025?



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. The level increased from 86% (as declared by participants in 2021) to 99% (this is also because most quality assurance systems require the use of an accredited laboratory).

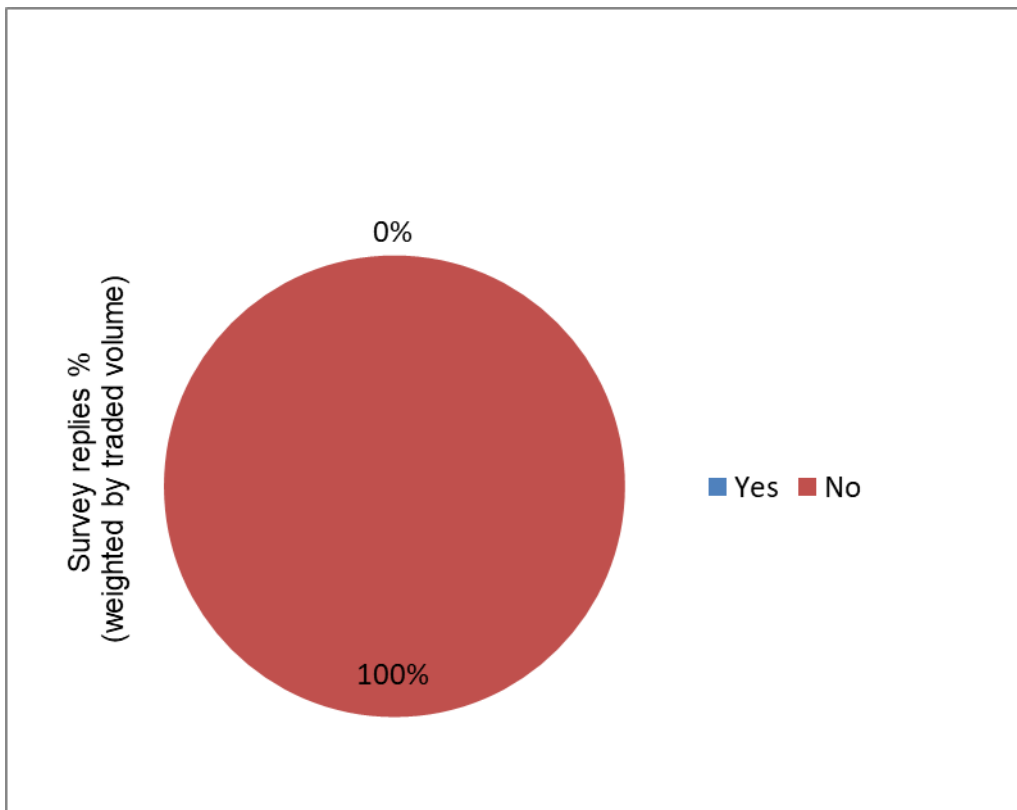
3 Regulation enforcement and controls

3.1 Have you been already controlled in the framework of the official regulation for mycotoxins in foodstuffs?



According to the survey replies, 28% of operators have been controlled within the framework of the official controls regulation on mycotoxins. This percentage was slightly higher in the 2021 report (43%).
The relevant controls authorities in the EU member States were Food (and feed) Safety agencies and Ministries of agriculture.
Most of our members, which received an official control in the framework of the official control regulation for mycotoxins in foodstuffs, experienced delays in reporting by the relevant Official control authority.

3.2 Apart from exceeding regulatory limits, did you have to conduct a product recall?



No participants had to recall a product lot.

4 General open questions

This section is a complete new one since previous editions of the COCERAL Mycotoxins survey, with a series of qualitative open questions, meant to assess how our members perceive the risk of mycotoxins, how they prevent it, and how they think that the effect of climate might impact mycotoxins occurrence in the next 10 years. Moreover, they have been asked about the constraints that (considering a possible increase in occurrence and co-occurrence of different mycotoxins in cereals and oilseeds) current or new EU regulatory levels for such mycotoxins will pose to them.

4.1 Please list which measures you take to prevent and mitigate mycotoxins risks in your business, and which ones are asked by your customers

- Recommending the farmers to harvest the grains when it is ready and dry, and cool the grains slowly and gently
- Use meteorological surveys at critical stages for the crops (i.e., flowering), which considerably supports a mycotoxins risk assessment
- Use of certified (according to voluntary food and feed safety certification schemes, such as EFISC-GTP, GMP+ etc) suppliers
- Adoption of internal monitoring (sampling and testing) programs (both at receipt, storage and pre-shipment), keeping into account of customer requirements
- Use of contract terms and specifications
- Sampling performed by skilled and experienced personnel and/or surveyors (i.e., SGS, GAFTA)
- Use of good storage and housekeeping practices (i.e., cooling, ventilation, etc)

4.2 Please list which measures your suppliers declare to prevent and mitigate mycotoxins risks in the field

- Recommending the farmers to
 - Always use certified seeds, when possible
 - Adopt sound crop rotations
 - Harvest the grains when it is ready and dry, and cool the grains slowly and gently
 - Treat crops in the field with fungicides, when the weather imposes it.
- Asking the farmers to
 - sign an agreement where they declare compliance with (above mentioned) good agricultural practices
 - perform sampling and testing (with rapid tests) before loading/delivery.

4.3 Please estimate which mycotoxins might become more prevalent in the future (next 10 years) in the country/ies you source your grains and oilseeds, also in relationship with effect of climate change

(Note: the top 6 mycotoxins indicated by our members are as follow, listed in order of decreasing relevance for our members)

1. Aflatoxins (mostly in corn) due to increasingly common total heatwaves
2. Ochratoxins (mostly in corn)
3. All Fusarium toxins, namely:
 - T-2 + HT-2 Toxins, Deoxynivalenol, in cereals
 - Zearalenone, especially in oilseeds and oilseed meals
4. Ergot sclerotia
5. *Tilletia* spp (agents of Karnal/Indian/partial bunt of wheat)
6. Rust fungi

4.4 Which constraints have you experienced, or do you expect when new regulatory levels for mycotoxins are going to be proposed/voted in the EU?

(Note: the top 4 constraints indicated by our members are as follow, listed in order of decreasing relevance for our members)

1. An increasing % of grains (fit for human consumption) will have to be declassified as feed, as EU regulatory levels for mycotoxins in food will likely not be met (as the prevalence and co-occurrence of different mycotoxins will likely increase). In the worst-case scenario, a certain % of grains (i.e., corn) will not even meet the maximum levels foreseen by the EU for feed material, and such grains will have to be used for bioethanol production or even wasted/incinerated
2. Lack of correlation between the physical quantity of ergot sclerotia and the observed levels of ergot alkaloids (surveys show that 250 ppb of ergot alkaloids can be detected in wheat samples even if no ergot sclerotia have been detected on the sample wheat sample)
3. The more accurate the measurement method will become, the more regulation are expected to come for the food and feed industry
4. Although the observed level of mycotoxins in certain EU member State is very low and very far from EU maximum limits, climate change might cause unpredictable results.

ANNEX 1: QUESTIONNAIRE “MYCOTOXIN MANAGEMENT” 2023

YOUR COMPANY IS (more than one answer is possible):

Providing advice and selling seeds and/or Plant Protection Products (PPPs) (Agro-supply advisor on the use of PPPs)

↳ Please state approx. how many farmers:

Collecting grains from farmers

↳ Collected volume of grains (Crop year 2022/2023): tons

Trading volumes of grains among the EU Member States

↳ Purchased volume from collectors (Crop year 2022/2023): tons

Importing volumes of grains into the EU *

↳ Imported volume into the EU (Crop year 2022/2023): tons

Other, please specify:

* harvesting time (**for grains, including rice**) for crop year 2022-2023 goes from **April 2022 to November 2022** in Northern hemisphere exporting countries (i.e., US, Canada, Russia, Ukraine, CIS countries, etc.) and from **September 2022 to June 2023** in Southern hemisphere exporting countries (i.e., Brazil, Argentina, Australia, China, India, ASEAN countries, etc.) (source: <https://ipad.fas.usda.gov/ogamaps/cropcalendar.aspx>)

SECTION 1. MINIMISING RISKS POSED BY MYCOTOXINS IN THE FIELD (ONLY for agrosupply members)

1.1 . Do you specifically advise farmers on mycotoxins management?

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

1.2 . How do you manage risks of mycotoxins in the field? (more than one answer is possible)

- 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 farmers, what kind of approach to manage mycotoxins are you using (more than one answer is possible)

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

1.4.1. In case you apply the Forecast Model, by whom has it been proposed?

- Plant protection companies
 Seed breeders
 Technical institutes
 Public authorities

1.5 . After advising farmers, the management of mycotoxins risks at farm level:

- Improves
 Stagnates
 Worsens

SECTION 2. SAMPLING, ANALYSIS AND DETECTION OF MYCOTOXINS (ONLY for grain collectors and traders)

2.1. Do you carry out sampling in your lots for the detection of mycotoxins?

- NO (if no, please go to SECTION 3)
 YES:

2.1.1 If YES, which mycotoxin/s are you analyzing and in which crop/s? Please tick the cells of the table below for each crop/mycotoxin combination

	Wheat	Barley	Oats	Maize/Corn	Other (please specify which crop/s)
Zearalenon (ZEA/ZON)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fumonisin (B1; B2 etc)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Deoxynivalenol (DON) and its acetylated and modified forms (3-Ac-DON; 15-Ac-DON; DON3G)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
T-2/HT-2 (and their sums)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ochratoxin A (OTA)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Aflatoxins (B1, B2, G1, G2)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Nivalenol	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ergot sclerotia/alkaloids	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Enniatins	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (please specify)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2.1.2 If YES, can you please explain in details how your company is assessing the risk for certain myco/crop combinations? – please specify

2.2. Which sampling method/s is/are used by your company for mycotoxins analyses?

- Official controls Regulations (EU Reg. 401/2006 (food) and/or EU Reg. 691/2013 (feed))
 CEN method EN/ISO 24333:2009
 Internal method – please specify
 Contractual method (e.g., GAFTA 124, FOSFA) – please specify
 An aflatoxin protocols (e.g., GMP+, EFISC-GTP, etc) – please specify

2.2.1 Which constraints have you experienced in sample taking for mycotoxin analysis? – please specify

2.3. According to your activities, when do you test your lots for mycotoxins? (more than one answer is possible)

	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? (more than one answer is possible)

- Systematic for all entries
- Based on a monitoring plan
- Based on a monitoring plan and risk assessment (please specify)

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

- Yes
- No

2.5.1 If YES, please specify under which of the above mentioned certification scheme/s you are accredited

2.6 Do you carry out visual tests?

- Yes, only visual tests
- Yes, together with rapid test systems
- No

2.7 Do you carry out your own mycotoxins analysis at your company?

- Yes
- No

2.7.1 If YES, which kind of method of rapid test do you use for mycotoxin detection at your company?

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

2.7.2 Who is/are your supplier(s) of rapid 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)		

2.8 Do you carry out analysis to evaluate the presence of mycotoxins by external laboratories?

- Yes
- No

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

- Because you do not have your own testing equipment
- To complement your internal analysis
- To validate your internal analysis

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

- Enzyme-linked immunosorbent assay (ELISA) method
 - Standardised method (please specify):
 - Internal method (please specify):
- HPLC technique
- GC technique
- I don't know

2.9 Is your testing laboratory accredited for mycotoxins in questions (see above) in accordance with the international standard ISO/IEC 17025:2017?

- Yes
- Yes, but only for the following mycotoxins (please specify which ones):
- No
- I don't know

SECTION 3. REGULATION ENFORCEMENT AND CONTROLS

3.1. Have you been already controlled in the framework of the official regulation for mycotoxins in foodstuffs?

- Yes
- No

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

3.1.3 Which constraints (if any) have you experienced during official controls (i.e. sample preparation and taking, delays in reporting, transparency, etc)? Please specify

3.2. Apart from exceeding regulatory limits, did you have to conduct a product recall?

- Yes
- No

3.3 If yes, was that recall the result of an official control or due to a commercial complaint?

- Official control
- Commercial complaint

SECTION 4. GENERAL OPEN QUESTIONS

4.1 Please list which measures you take to prevent and mitigate mycotoxins risks in your business, and which ones are asked by your customers

4.2 Please list which measures your suppliers declare to prevent and mitigate mycotoxins risks in the field

4.3 Please estimate which mycotoxins might become more prevalent in the future (next 10 years) in the country/ies you source your grains and oilseeds, also in relationship with effect of climate change

4.4 Which constraints have you experienced or will you expect when new regulatory levels for mycotoxins are going to be proposed/voted in the EU?

ANNEX 2: METHOD FOR REPLIES PROCESSING

- **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 14% 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-dependent 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

