Workshop:

Monitoring and reporting mycotoxin contamination in cereal foods and raw materials

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Workshop programme

This workshop co-hosted by Food Standards Scotland and the Rowett Institute took place on Wednesday, 9th May 2018.

With this event we aimed to capture views from different stakeholders on the current state of mycotoxin monitoring and identify potential areas of concern.

To facilitate the day we have invited a range of speakers to give short presentations, and we would like to encourage discussion around the issues of mycotoxin monitoring.

Time	Speaker	Affiliation	Title
10.30 - 11.00	Arrival and coffee		
11.00 - 11.15	**Will Munro**	FSS	Welcome
11.15 - 11.30	**Silvia Gratz**	Rowett Institute	Scottish Government funded research on mycotoxins and masked mycotoxins
12.30 - 11.40	Discussion		
11.40 - 11.55	**Susan McDonald**	FERA ltd	FSS Contaminants Review – mycotoxins present and emerging risks
11.55 - 12.05	Discussion		
12.05 - 12.20	**Derek Croucher**	Morningfoods BOMBA	Mycotoxins in UK Oats
12.20 - 12.30	Discussion		
12.30 - 13.15	Lunch		
13.15 - 13.30	**Marian McEwan**	Science and Advice for Scottish Agriculture (SASA)	Overview of work at SASA regarding Fungal testing
13.30 - 13.40	Discussion		
13.40 - 13.55	**Catherine Barrett**	Agricultural Industries Confederation (AIC)	Field to store issues with cereal mycotoxins
13.55 - 14.05	Discussion		
14.05 - 14.20	**Jane White**	Glasgow Scientific Services	Public Analyst perspective and capabilities
14.20 - 14.30	Discussion		
14.30 - 15.00	General discussion		General discussion
15.00 – 16.00	*Tour of Official Seed Testing Station for Scotland (OSTS)/ LCMS-MS mycotoxin testing facility*		*Science and Advice for Scottish Agriculture (SASA)*

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Delegates:

Barry Harrison	Scotch Whisky Research Institute
Catherine Barrett	Agricultural Industries Confederation
Derek Croucher	Morningfoods/BOMBA
Gary Stoddart	Scottish Organic Producers Association
Helen Pratt	University of Aberdeen/BBSRC
Jane White	Glasgow Scientific Services
Jillian Fisher	Diageo
Josep Campins	Food Standards Scotland
Marian McEwan	Science and Advice for Scottish Agriculture
Neil Havis	Scotland's Rural College
Robin Barron	East of Scotland Farmers
Silvia Gratz	Rowett Institute
Susan Fraser	Harbro
Susan MacDonald	FERA Science Ltd
Will Munro	Food Standards Scotland

Summary of the day

The discussion focussed on Fusarium mycotoxins which are the most relevant toxins in terms of UK primary agricultural production. Mycotoxins of interest include trichothecenes such as deoxynivalenol, nivalenol (type B trichthecenes), T2 and HT2 toxins (type A trichothecenes), as well as zearalenone. In addition to Fusarium mycotoxins, ergot alkaloids were another group of compounds that were discussed extensively.

Welcome and overview

Will Munro from Food Standards Scotland gave a brief overview of mycotoxins of concern and mycotoxin formation throughout the food chain. He then summarised the relevant EU regulations concerning mycotoxins in food and feed.

Scottish Government funded research on mycotoxins and masked mycotoxins

Silvia Gratz from the Rowett Institute gave on overview of SG funded research on plant-bound mycotoxin metabolites, so-called masked (or modified) mycotoxins. She described her mechanistic research using in-vitro models to demonstrate that masked mycotoxins are not absorbed in the small intestine, but will contribute to human exposure following microbial hydrolysis and release of free parent mycotoxins by gut microbiota. She also presented findings on the presence of masked and free Fusarium mycotoxins (trichothecenes and zearalenone) in Scottish cereals from a collaborative project with SASA and SRUC. Furthermore, she presented pilot results on dietary exposure to T2 and HT2 toxins from the consumption of oat-based foods.

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FSS Contaminants Review – mycotoxins present and emerging risks

Susan MacDonald from FERA Science Ltd presented findings from a recent review on important food contaminants in the Scottish context. This review highlighted Fusarium mycotoxins and ergot alkaloids as important contaminants and found that T2 and HT2 toxins pose a specific problem for Scottish oat production. From a collaborative study funded by the Agriculture and Horticulture Development Board (AHDB) she presented findings of the occurrence of mycotoxins in wheat, oat and barley samples destined for food and feed production. Deoxynivalenol (DON) was frequently detected across all commodities while T2+HT2 were mainly found in oat samples. Modified forms of both groups were also present at lower levels and frequency and zearalenone (ZON) was rarely found. Ergot alkaloids were also found frequently and across all commodities while alternaria toxins were rarely detected.

Mycotoxins in UK Oats

Derek Croucher from the British Oat and Barley Millers' Association (BOMBA) gave an excellent and detailed overview of T2 and HT2 toxins in oats highlighting the issues for the industry deriving from milling and processing practices prevalent in the UK in comparison to EU. He showed, repeatedly over 4 years of data, that intake oat samples collected in Scotland were contaminated with higher levels of T2/HT2 compared to England. Furthermore, samples exceeding the indicative level of 1000 µg/kg were found more frequently in Scotland. However, in his conclusion Derek stressed that all milled oat samples were consistently below the indicative level, which is also supported by an FSA retail survey. T2Glucoside was only detected occasionally. He also highlighted the important health benefits of consuming oats.

This presentation triggered an in-depth discussion on T2/HT2 Indicative Levels in cereals and the potential impact on the oat industry. Currently there is no rapid test (<10 minutes) for T2/HT2 - this makes testing at intake impossible and results would be received after the intake oats had been milled (and in some cases consumed). This was however not considered a food safety concern given the in-mill blending that occurs (NB the blending is actually carried out for quality reasons) coupled with the in-process mycotoxin reduction that happens through cleaning and husk removal which reduces the levels below the milled product Indicative Level. Intake cereal lots that exceed any future legislative levels must not be utilised in the food chain, but with no rapid test this will result in a massive disruption in the supply chain. With the TDI for T2/HT2 being lowered, potential consumer exceedance of the TDI may be more likely. Such tightening of standards is a major concern for the industry which urged a proportionate approach balancing risk against the benefits of oat consumption.

Overview of work at SASA regarding fungal testing

Marian McEwan from Science and Advice for Scottish Agriculture (SASA) presented an overview of the work conducted at SASA; specifically focussing on the Official Seed Testing Station for Scotland (OSTS). She described the quality tests for purity and germination as well as tests for important pathogens such as ergot, and loose smut, and then focussed more on Fusarium species. She presented findings on the presence of total Fusarium species on oat, wheat and barley samples over several years and also described the Fusarium species isolation and identification work. Following the

workshop discussions she led a guided tour of the SASA facilities and OSTS as well as the analytical facilities focussing on pesticide detection.

Field to store issues with cereal mycotoxins

Catherine Barrett from the Agricultural Industries Confederation (AIC) gave an introduction to ergot alkaloids, explained the difference between grass and cereal ergot and described the role of black grass as host for grass ergot. She mentioned that black grass, to date, is not a problem in Scotland yet but is very prevalent in England and spreading northwards. Grass ergot is a bigger problem in wheat and barley whereas rye is more frequently contaminated with cereal ergot. In oats, cereal ergots were not detected, whereas grass ergot could be found.

Ergot contamination is regulated in the industry which employs colour sorters to remove ergot sclerotia from cereals. There are currently no rapid tests for ergot alkaloids which could be used by the industry. Rapid testing is routinely performed for DON and ZEN, but no rapid testing is available for modified forms.

Public Analyst perspective and capabilities

Jane White from Glasgow Scientific Services (GSS) presented an interesting insight into the mycotoxin testing work of public analyst labs. She discussed issues of sampling, such as homogeneity of bulk samples and representative sampling of retail products, as well as the added complexity of providing reference samples for potential legal actions. She also discussed advantages of different mycotoxin detection methods comparing ELISA, HPLC and LCMSMS.

Main points of discussion

T2/HT2 toxins

T2/HT2 is frequently detected in oats and a particular issue has been highlighted with oats grown in Scotland. Contamination varies greatly between years and intermittently much higher levels are detected, while organic agronomic techniques (such as long crop rotation) appear to lower T2/HT2 levels. The Indicative Level is set at 1000 µg/kg for unprocessed oats which in Recommendation 2013/165/EU refers to oats (with husk); the Contaminants Regulation (EC) 1881/2006 refers to unprocessed cereals however MLs have not been set yet. Cleaned and milled oat samples rarely if ever exceed these levels, while intake oats samples test positive more frequently. This is due to a blending effect during the milling process. T2/HT2 as well as their masked metabolites are also detectable in oat-based cereal foods but at levels below the Indicative Level. Testing of masked T2/HT2 remains difficult as no analytical reference standards are available. Although the Recitals to the Recommendation state that 'chronic human dietary exposure to the sum of T-2 and HT-2 toxins are not an immediate health concern; EFSA risk assessments have recently been revised leading to a lowering of the TDI for T2+HT2 from 0.1 to 0.02 µg/kg bw. Analysis of a small dietary intervention study suggests exceedances of this new TDI may occur in high oat consumers. Further evidence needs to be gathered on human exposure, especially during years of high prevalence of T2+HT2 in agricultural crops. There was a need for a proportionate approach to regulating these toxins taking

into account both risks and benefits. It was suggested a risk/benefit assessment could be requested of the independent advisory committees SACN & COT (Scientific Advisory Committee on Nutrition; Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment) who had previously carried out a risk benefit analysis on fish consumption benefits versus contaminant risks – https://cot.food.gov.uk/sites/default/files/cot/fishreport200401.pdf

Ergot alkaloids

Ergot alkaloids have been highlighted as an area of concern in recent years both at the UK and EU level. Ergot alkaloids are produced by cereal ergot or by grass ergot which infects black grass as a grassweed host. The presence of ergot sclerotia is a visible indicator for contamination and the number of sclerotia is correlated with the levels of ergot alkaloids. However, ergot alkaloids may be detected in apparently uninfected grain and little is known about the production of ergot alkaloids and their distribution within the cereal grain. It is suspected that minimum/no till techniques result in higher ergot levels.

Discussions are ongoing on setting ML for ergot alkaloids in cereal-based products, but the availability of the analytical methods and reference materials to test for these compounds is a continuous issue.

Brexit and contaminant monitoring.

The EU operates and funds an extensive testing and monitoring programme for contaminants in food and raw materials entering the common market through non-EU imports. This monitoring programme frequently detects high-level mycotoxin contamination in cereal and nut imports which led to 418 border rejections in the 2016 annual RASFF report (https://ec.europa.eu/food/sites/food/files/safety/docs/rasff_annual_report_2016.pdf). Additionally, most imports enter through non-UK ports (e.g. Rotterdam), where testing takes place and they then have free movement across the EU. Upon the UK leaving the EU, this free movement and testing capacity is highly likely to be lost and will need to be replaced by a tailor-made UK system to ensure the safety of the incoming agricultural commodities. The current chemical contaminant testing capability in the UK (including mycotoxins) is already depleted, in part due to funding cuts, and discussion on this topic did not offer any insights into how this might be resolved.