

Annual Project Report

August 2014 to August 2015



Project title	Monitoring of mycotoxins and other contaminants in UK cereals used in malting, milling and animal feed		
Project number	RD-2012-3779		
Start date	8 August 2012	End date	8 August 2016

Project aim and objectives
To survey the incidence and levels of key contaminants in representative samples of UK-grown cereals (wheat, barley and oats) and co-products (wheatfeed and oatfeed), destined for milling, malt production, and animal feed to determine that they meet legal compliance guideline limits and are safe for human consumption.

Key messages emerging from the project
<p>During the period August 2014 to July 2015, the project focussed on the monitoring of harvest and stored grain samples for fusarium toxins, ochratoxin A, agrochemicals and metals in grain samples from the 2014 harvest. The samples included milling wheat, feed wheat, feed barley, feed oats, wheatfeed, oatfeed, malting barley and malt. Also included were results of analysis for ergot alkaloids from all 2014 harvest samples, and dioxins (& dioxin-like PCBs) in selected feed samples. It should be noted that the data reported is not intended to provide a comprehensive monitoring of the UK grain harvest; the data represent levels likely to be found in each of the sample types within the given year of sampling.</p> <p>The following observations are made from the data reported in Tables 1–15.</p> <ul style="list-style-type: none"> ❖ A proportion of all sample types contained detectable levels (>0.1µg/kg) of ochratoxin A (OTA) after storage. One sample of milling wheat exceeded the legislative limit (5 µg/kg). ❖ Stored barley contained detectable levels of deoxynivalenol (DON) in 19% of samples, and HT-2 + T-2 fusarium toxins in 56% of samples; zearalenone (ZON) was not detected in any of these samples. All samples were within EU legislative limits. ❖ DON levels in malt samples were similar to stored malting barleys, thereby showing no effect of processing. This was in contrast to HT-2 and T-2 toxins which showed reductions in both incidence and levels in the in the finished malt compared to the original barleys. ❖ All pesticide residues in stored samples were well within respective maximum residue levels (MRLs). Pirimiphos-methyl, deltamethrin and chlorpyrifos methyl were the most frequently detected pesticides. ❖ Ergot alkaloids were detected in 45% of all 2014 harvest samples. ❖ A subset of feed barley and feed wheat samples were analysed for dioxins. All samples were within regulatory limits.

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- ❖ 95% of milling wheat samples contained detectable levels of glyphosate and chlormequat, though all were within MRLs.
- ❖ Metals (lead, cadmium, arsenic, mercury, and nickel) were detected in many samples though these were very low levels.

Summary of results from the reporting year

Fusarium Toxins

Table 1. Deoxynivalenol Harvest Results 2014

	No. of Samples Analysed	% > LOD	Minimum level µg/kg	Maximum level µg/kg	Mean level µg/kg	Mode level µg/kg	Median level µg/kg
Milling wheat	75	92	<10	755	110	<10	58
Feed wheat	10	60	<10	61	15	<10	15
Wheatfeed	20	100	48	650	242		225
Feed Barley	11	55	<5	44	13	<5	5
Malting Barley	42	38	<5	33	6	<5	<5
Feed Oats	12	58	<5	309	36	<5	6
Oatfeed	10	90	<5	859	155		81

Table 2. Zearalenone Harvest Results 2014

	No. of Samples Analysed	% > LOD	Minimum level µg/kg	Maximum level µg/kg	Mean level µg/kg	Mode level µg/kg	Median level µg/kg
Milling wheat	75	15	<2	10	<2	<2	<2
Feed wheat	10	30	<2	18	3	<2	<2
Wheatfeed	20	90	<2	26	7	2	4
Feed Barley	11	0	<2	<2	<2	<2	<2
Malting Barley	42	7	<2	24	<2	<2	<2
Feed Oats	12	8	<2	24	2	<2	<2
Oatfeed	10	30	<2	25	6	<2	<2

Table 3. HT-2 +T 2 Harvest Results 2014

	No. of Samples Analysed	% > LOD	Minimum level µg/kg	Maximum level µg/kg	Mean level µg/kg	Mode level µg/kg	Median level µg/kg
Milling wheat	75	0	<10	<10	<10	<10	<10
Feed wheat	10	0	<10	<10	<10	<10	<10
Wheatfeed	20	0	<10	<10	<10	<10	<10
Feed Barley	11	18	<5	24	<5	<5	<5
Malting Barley	42	14	<5	43	<5	<5	<5
Feed Oats	12	92	<5	905	175		54
Oatfeed	10	100	148	4310	1197		768

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Table 4. Ergot Alkaloids Harvest Results 2014 (Total Combined Ergot Alkaloid Values)

	No. of Samples Analysed	% > LOD	Minimum level µg/kg	Maximum level µg/kg	Mean level µg/kg	Mode level µg/kg	Median level µg/kg
Milling wheat	75	45	0	1738	59	0	0
Feed wheat	10	20	0	90	10	0	0
Wheatfeed	20	100	3	811	163		112
Feed Barley	11	9	0	309	28	0	0
Malting Barley	32	30	0	149	13	0	0
Feed Oats	12	17	0	601	52	0	0
Oatfeed	10	70	0	121	26	0	10

Table 5. Milling Wheat Agrochemical Harvest Results 2014

	No. of Samples Analysed	% > LOD	Minimum level µg/kg	Maximum level µg/kg	Mean level µg/kg	Mode level µg/kg	Median level µg/kg
Glyphosate	20	95	<10	1403	165	17	27
Chlormequat	20	95	<10	519	197	87	177
Mepiquat	20	10	<10	81	<10	<10	<10

Table 6. Dioxins Feed Samples

	No. of samples analysed		Upper Bound@ 0% moisture-ng/kg (Min/Max Range)
Feed Barley	5	Dioxins and Furans (Based on US EPA 1013)	0.046 – 0.17
		Poly-Chlorinated Biphenyls (WHO 12)	0.072 – 0.16
Feed Wheat	5	Dioxins and Furans (Based on US EPA 1013)	0.13 – 0.14
		Poly-Chlorinated Biphenyls (WHO 12)	0.067 – 0.068

Table 7. January 2015 Storage Results –Ochratoxin A

	No. of Samples Analysed	% > LOD	Minimum level µg/kg	Maximum level µg/kg	Mean level µg/kg	Mode level µg/kg	Median level µg/kg
Milling wheat	50	16	<0.1	3.6	0.2	<0.1	<0.1

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Table 8. Barley and Malt Pairs 2015 – Field Mycotoxins

Mycotoxin		No. of Samples Analysed	% > LOD	Minimum level µg/kg	Maximum level µg/kg	Mean level µg/kg	Mode level µg/kg	Median level µg/kg
Deoxynivalenol	Malting Barley	16	19	<5	42	<5	<5	<5
	Malt	16	25	<5	29	5	<5	<5
Zearalenone	Malting Barley	16	0	<2	<2	<2	<2	<2
	Malt	16	0	<2	<2	<2	<2	<2
HT-2 +T 2	Malting Barley	16	56	<2	15	5	<2	4
	Malt	16	19	<2	3	<2	<2	<2

Table 9. Barley and Malt Pairs 2015 – Ochratoxin A

		No. of Samples Analysed	% > LOD	Minimum level µg/kg	Maximum level µg/kg	Mean level µg/kg	Mode level µg/kg	Median level µg/kg
Ochratoxin A	Malting Barley	19	5	<5	0.4	<0.1	<0.1	<0.1
	Malt	19	16	<5	0.4	<0.1	<0.1	<0.1

Table 10. March 2015 Storage Pesticide Results

	No. of Samples Analysed	% >LOD	Single Pesticide Incidence % >LOD	Multiple Pesticide Incidence % >LOD
Milling wheat ¹	50	18	14	4
Malting Barley ²	19	11	11	0
Feed Wheat	18	0	0	0
Wheatfeed ³	10	10	10	0
Feed Barley	13	0	0	0
Feed Oats ⁴	10	20	20	0
Oatfeed ⁵	8	38	13	25

1. Pirimiphos methyl : 0.04- 1.08 mg/kg, malathion : 0.03 mg/kg, chlorpyrifos methyl : 0.02 – 0.24 mg/kg. Deltamethrin : 0.02 – 0.07 mg/kg.
2. Pirimiphos methyl : 0.01 mg/kg, deltamethrin : 0.03 mg/kg
3. Pirimiphos methyl : 1.44 mg/kg
- 4 Pirimiphos methyl : 0.65 mg/kg. chlorpyrifos methyl: 0.03 mg/kg
5. Pirimiphos methyl : 0.01 – 0.04 mg/kg. chlorpyrifos methyl: 0.01 - 0.02 mg/kg

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Table 11. March 2015 Ochratoxin A Storage Results

	No. of Samples Analysed	% > LOD	Minimum level µg/kg	Maximum level µg/kg	Mean level µg/kg	Mode level µg/kg	Median level µg/kg
Milling wheat	50	10	<0.1	9.9	0.2	<0.1	<0.1
Feed wheat	35	20	<0.1	5.5	0.3	<0.1	<0.1
Wheatfeed	10	80	<0.1	1.6	0.5	<0.1	0.5
Feed Barley	24	17	<0.1	29.5	1.4	<0.1	<0.1
Feed Oats	11	27	<0.1	139	12.8	<0.1	<0.1
Oatfeed	8	88	<0.1	1.9	1.1	0.5	1.1

Table 12. Milling Wheat Metal Results

	No. of Samples Analysed	% > LOD	Minimum level µg/kg	Maximum level µg/kg	Mean level µg/kg	Mode level µg/kg	Median level µg/kg
Lead	75	27	<0.01	0.06	<0.01	<0.01	<0.01
Cadmium	75	100	0.01	0.11	0.03		0.03
Arsenic	75	4	<0.01	0.02	<0.01	<0.01	<0.01
Mercury	75	3	<0.01	0.03	<0.01	<0.01	<0.01
Nickel	75	100	0.02	0.31	0.10		0.09

Table 13. Malting Barley Metal Results

	No. of Samples Analysed	% > LOD	Minimum level µg/kg	Maximum level µg/kg	Mean level µg/kg	Mode level µg/kg	Median level µg/kg
Lead	20	50	<0.01	0.04	0.01	<0.01	0.01
Cadmium	20	38	<0.01	0.05	0.01	<0.01	<0.01
Arsenic	20	92	<0.01	0.02	0.01	0.01	0.01
Mercury	20	0	<0.01	<0.01	<0.01	<0.01	<0.01
Nickel	20	100	0.08	0.27	0.15		0.15

Table 14. Wheatfeed Metal Results

	No. of Samples Analysed	% > LOD	Minimum level µg/kg	Maximum level µg/kg	Mean level µg/kg	Mode level µg/kg	Median level µg/kg
Lead	19	89	<0.01	0.18	0.04	<0.01	0.03
Cadmium	19	100	0.05	0.09	0.07		0.07
Arsenic	19	63	<0.01	0.03	0.01	<0.01	0.01
Mercury	19	0	<0.01	<0.01	<0.01	<0.01	<0.01
Nickel	19	100	0.13	0.50	0.31		0.31

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Table 15. Feed Wheat Metal Results

	No. of Samples Analysed	% > LOD	Minimum level µg/kg	Maximum level µg/kg	Mean level µg/kg	Mode level µg/kg	Median level µg/kg
Lead	9	33	<0.01	0.03	0.01	<0.01	<0.01
Cadmium	9	100	0.02	0.06	0.04		0.03
Arsenic	9	11	<0.01	0.04	<0.01	<0.01	<0.01
Mercury	9	0	<0.01	<0.01	<0.01	<0.01	<0.01
Nickel	9	89	<0.01	0.18	0.08		0.06

Key issues to be addressed in the next year

Representative sample sets of milling wheat, feed wheat, feed barley, feed oats, wheatfeed and oatfeed from the 2015 harvest will be collected and selectively analysed for mycotoxins, pesticides, and dioxins. A representative sample set of malting barleys, and of the malts produced from these barleys, will be analysed similarly.

Lead partner	Campden BRI (Chipping Campden) Ltd.
Scientific partners	Campden BRI (Nutfield) Ltd.
Industry partners	AIC, MAGB, nabim
Government sponsor	

Has your project featured in any of the following in the last year?

Events	Press articles
Conference presentations, papers or posters	Scientific papers
Other	

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