Annual Project Report
August 2018 to June 2019

Project title	Monitoring of mycotoxins and other contaminants in UK cereals used in malting, milling and animal feed		
Project number	21130040		
Start date	August 2016	**End date**	August 2021

Project aim and objectives
To survey the incidence and levels of key contaminants in samples of UK-grown and imported cereals and co-products, destined for milling, malt production and animal feed, to determine that they meet legal and guideline limits and are safe for consumption as food and feed.

Key messages emerging from the project
During the period August 2018 to June 2019, the project focused on monitoring of harvest and stored grain samples for trichothecenes, zearalenone, ochratoxin A and pesticides. Subsets of samples were also analysed for ergot alkaloids, alternaria toxins, trace elements and acrylamide. The samples included milling wheat, malting barley, food oats, food barley, feed wheat, wheatfeed, feed barley, feed oats, oatfeed and roasted barley malt. The data is not intended to provide a comprehensive monitoring of the UK grain harvest; the data represents levels likely to be found in each of the sample types within a given year of sampling. The results from some of the most commonly detected mycotoxins have been compared with the results from the previous two years of this study, these and selected results from 2018 are presented below. • Mycotoxins – The maximum DON level found was 2158 µg/kg in an oatfeed, no sample exceeded the maximum level (ML). 100% of oatfeed, wheatfeed and food barley (1 sample) contained DON above the reporting limit (RL). Comparing results over the first three years of the project, in general, DON levels were lowest in 2018 for wheat and barley. There was a 60% incidence in feed barley in 2018 (compared to ca. 36% for the previous 2 years) resulting in a mean level of 15.1 µg/kg in 2018, that was higher than previous years. Conversely, 2018 produced the highest DON levels for oat products, although the levels were low. Oatfeed had the highest incidence of NIV (100%) as well as the highest mean (297 µg/kg) and maximum (1030 µg/kg) levels. There are no maximum levels for this mycotoxin. Feed barley had the second highest maximum level (644 µg/kg), but the mean was only 85 µg/kg, while the median and mode were both below the reporting limit (<50 µg/kg). In comparison to last year, where food barley was the only product to contain NIV, in 2018 at least one sample of each product contained detectable NIV.

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- Over the three years of the study, T-2 and HT-2 toxin levels were highest for milling wheat, feed barley and malting barley in 2018. The incidence in food oats has increased over three years to 100% in 2018, although its highest mean level was found in 2017, while the highest levels for oat feed were in 2016. In 2018, T-2 and HT-2 toxins were detected most frequently in oats (food and feed) and oatfeed, 100% oatfeed and food oats and 92% feed oats contained T-2 and HT-2 above the RL. The highest levels were found in oatfeed (4192 µg/kg compared to 2091 µg/kg in 2017). The mean levels found in food oats and feed oats were 443 and 114 µg/kg, respectively (similar to 2017 harvest). The mean levels for T-2 and HT-2 were below the suggested maximum level proposed for oats with husk of 500 µg/kg. However, the mean level found for malting barley in 2018 would exceed the proposed maximum level of 20 µg/kg.
- There was a lower incidence of zearalenone (ZEN) this year than in the harvest samples from 2017. ZEN was not detected in feed wheat, malting barley, food oats or food barley. The highest level in wheatfeed was 69 µg/kg and the maximum level found was 269 µg/kg in an oatfeed sample. In comparison, 2017 produced the highest ZEN levels for wheat and barley, the highest level found was a milling wheat that contained 327 µg/kg, and the mean level of 18.6 µg/kg was more than 10 ten times greater than the mean for 2018.
- Masked forms of DON, T-2 toxin and ZEN were also analysed. T-2 glucoside was detected in oats and oatfeed samples plus a small incidence in barley samples, the mean level found in oatfeed was 135 µg/kg and the maximum level found was 698 µg/kg. The highest maximum level was found in a food oat sample (907 µg/kg), although the mean value for food oats was 58 µg/kg. DON glucoside was found mainly in oatfeed samples, although the mean levels were low (142 µg/kg or lower). The highest level found was 557 µg/kg in a sample of oatfeed that also contained the highest level of DON. 50% of the oatfeed samples analysed contained levels of 3 Ac-DON and 30% also contained neosolaniol. Diacetoxyscirpenol was found in 7% of food oat samples but in no other matrix tested.
- Wheatfeed (60%) and oatfeed (80%) most frequently contained OTA. The highest level, 73 µg/kg, was found in wheatfeed. Food oats, malting barley and malt had the lowest incidence of OTA. No samples exceeded the ML for ochratoxin A (OTA).
- Over the 3 years of the study the highest maximum levels for ergot alkaloids were found in 2016, except feed barley which had the highest maximum level in 2017. Generally incidence of ergot alkaloids has decreased over the three years, although for feed barley it increased from 55% to 90% from 2017 to 2018, but the levels measured were much lower in 2018. On the whole, levels found have decreased over the three years, incidence, maximum and mean levels have all decreased for food oats. However, for feed oats the highest maximum level

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was found in 2017, but with the lowest incidence (18% vs 70% and 85% in 2016 and 2018, respectively). The highest level found in 2018 was 765 µg/kg in a milling wheat sample, although the mean level in milling wheat was only 36 µg/kg. Currently, there are no maximum levels for ergot alkaloids.

- Alternaria toxins were not detected in any of the 2018 samples.
- One residue of chlorpyrifos-methyl was detected at 0.16 mg/kg in a wheatfeed sample. The maximum residue level (MRL) is set at 0.05 mg/kg for chlorpyrifos-methyl in wheat. However, no MRLs are currently applicable for "products or part of products exclusively used for animal feed production".
- Two residues of chlorpropham were detected at 0.02 and 0.04 mg/kg in wheatfeed samples. However, no MRLs are currently applicable for "products or part of products exclusively used for animal feed production".
- One residue of chlorpropham was detected at 0.24 mg/kg in a feed oats sample. The maximum residue level (MRL) is set at 0.01 mg/kg for chlorpropham in oats.
- Four residues of chlorpropham were detected at 0.01, 0.02 and 0.04 mg/kg in milling wheat samples. The maximum residue level (MRL) is set at 0.01 mg/kg for chlorpropham in wheat.
- One residue of chlorpropham was detected at 0.013 mg/kg in a food oats sample. The maximum residue level (MRL) is set at 0.01 mg/kg for chlorpropham in oats.
- One residue of DDAC (didecyldimethylammonium chloride) was detected at 0.32 mg/kg in a milling wheat sample. The maximum residue level (MRL) is set at 0.1 mg/kg for this disinfectant in all foodstuff.
- A high incidence of residues was found for PGRs (glyphosate, chlormequat, mepiquat). None of these residues exceeded their corresponding MRLs.
- Other most frequently found residues were tebuconazole and piperonyl butoxide (synergist). No MRL is set for piperonyl butoxide and all the tebuconazole residues were below the MRL.
- Metals - No samples were found to exceed the regulatory maximum levels. In line with the previous year, Hg was not detected in any of the samples. Al, Ni, and Cu were detected in all samples at similar ranges to those found the previous year.
- 15% of malt samples contained detectable levels of acrylamide, the mean level being 96 µg/kg. Regulation 2017/2158 sets maximum benchmark levels for acrylamide in various foodstuffs but does not include malt. The maximum level found was 1765 µg/kg in a roasted malt.

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Summary of results, including from the reporting year

Table 1. Deoxynivalenol Harvest Results 2016-2018

	No. of Samples Analysed	% > LOD	Minimum Level µg/kg*	Maximum Level µg/kg	Mean Level µg/kg	Median Level µg/kg
Milling Wheat 2016	51	96%	<20	1006	129	54
Milling Wheat 2017	50	98%	<10	1540	214	108
Milling Wheat 2018	50	50%	<10	420	48.5	5.3
Feed Wheat 2016	10	80%	<10	180	57	48
Feed Wheat 2017	11	100%	14.2	1127	250	171
Feed Wheat 2018	11	9%	<10	70.1	6.4	<10
Wheatfeed 2016	20	100%	28	819	429	478
Wheatfeed 2017	22	100%	28.4	2016	676	426
Wheatfeed 2018	21	100%	19.9	502	157	124
Feed Barley 2016	9	33%	<10	85	20	<10
Feed Barley 2017	11	36%	<10	58.9	10.7	<10
Feed Barley 2018	10	60%	<10	45.1	15.1	13.8
Malting Barley 2016	40	60%	<25	117	36	29
Malting Barley 2017	40	48%	<10	109	13.3	<10
Malting Barley 2018	40	20%	<10	39.6	3.7	<10
Food Oats 2016	30	23%	<10	132	15	<10
Food Oats 2017	29	7%	<10	11.8	0.8	<10
Food Oats 2018	29	66%	<10	160	23.4	17.9
Feed Oats 2016	10	40%	<10	33	9	<10
Feed Oats 2017	11	27%	<10	38.8	6.5	<10
Feed Oats 2018	13	46%	<10	231	28.5	<10
Oatfeed 2016	11	100%	16	332	64	37
Oatfeed 2017	10	100%	20.7	611	108	49.4
Oatfeed 2018	10	100%	33.4	2158	619	261

*Minimum level is the reporting limit, or average of measured values where 100% of samples contained a measurable level of toxin. Reporting limits in 2017 and 2018 were lower than in 2016 due to improvement in the analytical method.

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Table 2. Deoxynivalenol-3-Glucoside Harvest Results 2018

	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	14%	<10	90.0	6.1	<10	<10
Feed Wheat	11	0%	<10	<10	<10	<10	<10
Wheatfeed	21	62%	<10	37.1	13.7	<10	15.2
Feed Barley	10	30%	<10	21.2	5.7	<10	<10
Malting Barley	40	13%	<10	28.1	2.2	<10	<10
Food Oats	29	41%	<10	64.7	12.5	<10	<10
Food Barley	1	100%	14.9	14.9	<10	<10	<10
Feed Oats	13	38%	<10	128	15.5	<10	<10
Oatfeed	10	100%	11.2	557	142	N/A	58.2

Table 3. 3 Acetyl-Deoxynivalenol Harvest Results 2018

	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	0%	<10	<10	<10	<10	<10
Feed Wheat	11	0%	<10	<10	<10	<10	<10
Wheatfeed	21	0%	<10	<10	<10	<10	<10
Feed Barley	10	0%	<10	<10	<10	<10	<10
Malting Barley	40	0%	<10	<10	<10	<10	<10
Food Oats	29	3%	<10	16.0	0.6	<10	<10
Food Barley	1	0%	<10	<10	<10	<10	<10
Feed Oats	13	0%	<10	<10	<10	<10	<10
Oatfeed	10	50%	<10	364	96.5	<10	23.5

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Table 4. Zearalenone Harvest Results 2016-2018

	No. of Samples Analysed	% > LOD	Minimum Level µg/kg**	Maximum Level µg/kg	Mean Level µg/kg	Median Level µg/kg
Milling Wheat 2016	51	24%	<2.5	17	<2.5	<2.5
Milling Wheat 2017	50	70%	<3	327	18.6	7.4
Milling Wheat 2018	50	12%	<2.5	22.0	1.7	<2.5
Feed Wheat 2016	10	50%	<5	23	7	4
Feed Wheat 2017	11	82%	<2.5	916	114	29.1
Feed Wheat 2018	11	0%	<2.5	<2.5	<2.5	<2.5
Wheatfeed 2016	20	50%	<5	33	6	3
Wheatfeed 2017	22	95%	<2.5	94.7	32.9	25.5
Wheatfeed 2018	21	71%	<2.5	68.6	13.3	11.2
Feed Barley 2016	9	0%	<2.5	<25	<25	<25
Feed Barley 2017	11	9%	<2.5	5.5	0.5	<2.5
Feed Barley 2018	10	10%	<2.5	4.5	<2.5	<2.5
Malting Barley 2016	40	3%	<2.5	6	<2.5	<2.5
Malting Barley 2017	40	3%	<2.5	3.0	0.1	<2.5
Malting Barley 2018	40	0%	<2.5	<2.5	<2.5	<2.5
Food Oats 2016	30	3%	<2.5	4	<2.5	<2.5
Food Oats 2017	29	3%	<2.5	6.0	0.2	<2.5
Food Oats 2018	29	0%	<2.5	<2.5	<2.5	<2.5
Feed Oats 2016	10	20%	<2.5	8	1	<2.5
Feed Oats 2017	11	0%	<2.5	<2.5	<2.5	<2.5
Feed Oats 2018	13	8%	<2.5	15.1	1.2	<2.5
Oatfeed 2016	11	0%	<2.5	<25	<25	<25
Oatfeed 2017	10	50%	<2.5	63.5	9.5	1.3
Oatfeed 2018	10	60%	<2.5	269	71.8	11.3

**Minimum level is the reporting limit. Reporting limits in 2017 and 2018 were different to 2016 due to improvement in the analytical method.

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Table 5. β-Zearalenol Harvest Results 2018

	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	0%	<2.5	<2.5	<2.5	<2.5	<2.5
Feed Wheat	11	0%	<2.5	<2.5	<2.5	<2.5	<2.5
Wheatfeed	21	0%	<2.5	<2.5	<2.5	<2.5	<2.5
Feed Barley	10	0%	<2.5	<2.5	<2.5	<2.5	<2.5
Malting Barley	40	0%	<2.5	<2.5	<2.5	<2.5	<2.5
Food Oats	29	0%	<2.5	<2.5	<2.5	<2.5	<2.5
Food Barley	1	0%	<2.5	<2.5	<2.5	<2.5	<2.5
Feed Oats	13	0%	<2.5	<2.5	<2.5	<2.5	<2.5
Oatfeed	10	30%	<2.5	7.6	1.8	<2.5	<2.5

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Table 6. HT-2 + T-2 Harvest Results 2018

	No. of Samples Analysed	% > LOD	Minimum Level µg/kg*	Maximum Level µg/kg	Mean Level µg/kg	Median Level µg/kg
Milling Wheat 2016	51	0%	<20	<20	<20	<20
Milling Wheat 2017	50	8%	<20	64.0	2.9	<20
Milling Wheat 2018	50	10%	<20	139	4.7	<20
Feed Wheat 2016	10	20%	<20	32	5	<20
Feed Wheat 2017	11	0%	<20	<20	<20	<20
Feed Wheat 2018	11	0%	<20	<20	<20	<20
Wheatfeed 2016	20	0%	<40	<40	<40	<40
Wheatfeed 2017	22	32%	<20	52.0	8.9	<20
Wheatfeed 2018	21	33%	<20	30.7	7.9	<20
Feed Barley 2016	9	0%	<40	<40	<40	<40
Feed Barley 2017	11	27%	<20	69.7	18.2	<20
Feed Barley 2018	10	40%	<20	260	40.3	<20
Malting Barley 2016	40	38%	<10	91	10	<10
Malting Barley 2017	40	3%	<20	30.0	0.8	<20
Malting Barley 2018	40	65%	<20	210	37.6	<20
Food Oats 2016	30	70%	<20	1093	173	77
Food Oats 2017	29	97%	<20	1837	478	278
Food Oats 2018	29	100%	13.4	2745	443	188
Feed Oats 2016	10	60%	<40	437	115	65
Feed Oats 2017	11	82%	<20	716	225	81.7
Feed Oats 2018	13	92%	<20	582	114	48.6
Oatfeed 2016	11	100%	532	5787	1761	1366
Oatfeed 2017	10	100%	434	2091	1038	981
Oatfeed 2018	10	100%	515	4192	1299	676

*Minimum level is the reporting limit, or average of measured values where 100% of samples contained a measurable level of toxin. Reporting limits in 2017 and 2018 were lower than in 2016 due to improvement in the analytical method.

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Table 7. T-2-b3-Glucoside Harvest Results 2018

	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	0%	<10	<10	<10	<10	<10
Feed Wheat	11	0%	<10	<10	<10	<10	<10
Wheatfeed	21	0%	<10	<10	<10	<10	<10
Feed Barley	10	10%	<10	27.0	2.7	<10	<10
Malting Barley	40	8%	<10	45.3	1.8	<10	<10
Food Oats	29	59%	<10	907	58.0	<10	14.9
Food Barley	1	0%	<10	<10	<10	<10	<10
Feed Oats	13	23%	<10	67.6	8.4	<10	<10
Oatfeed	10	100%	18.5	698	135	N/A	44.8

Table 8. Nivalenol Harvest Results 2018

	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	4%	<50	94	3.2	<50	<50
Feed Wheat	11	9%	<50	50.3	4.6	<50	<50
Wheatfeed	21	33%	<50	80.9	21.1	<50	<50
Feed Barley	10	30%	<50	664	84.8	<50	<50
Malting Barley	40	25%	<50	156	26.6	<50	<50
Food Oats	29	45%	<50	591	103	<50	<50
Food Barley	1	100%	247	247	<50	<50	<50
Feed Oats	13	31%	<50	456	76.6	<50	<50
Oatfeed	10	100%	77.1	1030	297	N/A	172

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Table 9. Diacetoxyscirpenol Harvest Results 2018

	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	0%	<10	<10	<10	<10	<10
Feed Wheat	11	0%	<10	<10	<10	<10	<10
Wheatfeed	21	0%	<10	<10	<10	<10	<10
Feed Barley	10	0%	<10	<10	<10	<10	<10
Malting Barley	40	0%	<10	<10	<10	<10	<10
Food Oats	29	7%	<10	17.4	1.2	<10	<10
Food Barley	1	0%	<10	<10	<10	<10	<10
Feed Oats	13	0%	<10	<10	<10	<10	<10
Oatfeed	10	0%	<10	<10	<10	<10	<10

Table 10. Neosolaniol Harvest Results 2018

	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	0%	<10	<10	<10	<10	<10
Feed Wheat	11	0%	<10	<10	<10	<10	<10
Wheatfeed	21	0%	<10	<10	<10	<10	<10
Feed Barley	10	10%	<10	20.5	2.1	<10	<10
Malting Barley	40	5%	<10	22.1	0.9	<10	<10
Food Oats	29	45%	<10	225	26.7	<10	<10
Food Barley	1	0%	<10	<10	<10	<10	<10
Feed Oats	13	8%	<10	16.6	1.3	<10	<10
Oatfeed	10	90%	<10	56.2	29.5	N/A	22.6

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Table 11. Total Ergot Alkaloids (n=12) Harvest Results 2016-2018

	No. of Samples Analysed	% > LOD	Minimum Level*** µg/kg	Maximum Level* µg/kg	Mean Level* µg/kg	Median Level* µg/kg
Milling Wheat 2016	51	71%	<6.0	1435	79	6
Milling Wheat 2017	50	52%	<6.0	862	79.4	5.1
Milling Wheat 2018	50	42%	<6.0	765	36.0	<6.0
Malting Barley 2016	40	70%	<6.0	275	32	3
Malting Barley 2017	40	30%	<6.0	63.1	7.4	<6.0
Malting Barley 2018	40	65%	<6.0	122	8.6	1.6
Feed Wheat 2016	10	60%	<6.0	148	33	3
Feed Wheat 2017	11	45%	<6.0	140	24.3	<6.0
Feed Wheat 2018	11	45%	<6.0	7.4	1.2	<6.0
Wheatfeed 2016	20	100%	50	1086	404	372
Wheatfeed 2017	22	95%	<6.0	633	243	205
Wheatfeed 2018	21	90%	<6.0	326	62.3	40.3
Feed Barley 2016	9	67%	<6.0	69	15	3
Feed Barley 2017	11	55%	<6.0	383	71.4	8.7
Feed Barley 2018	10	90%	<6.0	32.1	6.1	1.1
Food Oats 2016	30	60%	< 6	710	45	8
Food Oats 2017	29	48%	<6.0	97.8	8.6	<6.0
Food Oats 2018	29	38%	<6.0	47.2	3.9	<6.0
Feed Oats 2016	10	70%	< 6	171	44	2
Feed Oats 2017	11	18%	<6.0	407	43.6	<6.0
Feed Oats 2018	13	85%	<6.0	159	18.1	3.2
Oatfeed 2016	11	100%	2	160	61	61
Oatfeed 2017	10	100%	16.3	111	48.4	43.1
Oatfeed 2018	10	100%	6.0	263	37.5	11.6

*** This is a combined value calculated from the sum of the individual 12 alkaloids. The LOQ of each alkaloid is 0.5 µg/kg. Where no residues are detected the LOQ values are combined to give a sum LOQ, 6.0 µg/kg. Where individual alkaloids are quantified above the LOQ, the sum is calculated from those values with results below the LOQ presumed to be equal to zero (lower bound result), which can result in values of less than 6.0 µg/kg being reported.

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Table 12. Pesticides Harvest Results 2018

	No. of Samples Analysed	% > LOD	Single Pesticide Incidence % > LOD	Multiple Pesticide Incidence % > LOD
Milling Wheat [1]	50	94%	30%	64%
Malting Barley [2]	40	90%	20%	70%
Food Oats [3]	29	97%	21%	76%
Barley [4]	1	100%	0%	100%
Feed Wheat [5]	11	27%	27%	0%
Feed Barley [6]	10	70%	70%	0%
Feed Oats [7]	13	62%	62%	0%

[1] Azoxystrobin (1) 0.01mg/kg; Boscalid (3) 0.01-0.02mg/kg; Epoxiconazole (1) 0.01mg/kg; Fluxapyroxad (1) 0.01mg/kg; Tebuconazole (27) 0.01-0.3mg/kg; Chlormequat (42) 0.06-1.1mg/kg; Mepiquat (10) 0.01-0.1mg/kg; Glyphosate (7) 0.1-1.3mg/kg.

[2] Azoxystrobin (1) 0.02mg/kg; Bixafen (4) 0.01-0.09mg/kg; Boscalid (1) 0.03mg/kg; Chlorothalonil (2) 0.03-0.04mg/kg; Cyprodinil (2) 0.02-0.09mg/kg; Epoxiconazole (3) 0.02-0.03mg/kg; Fluxapyroxad (3) 0.04-0.2mg/kg; Prothioconazole (3) 0.01-0.05mg/kg; Tebuconazole (1) 0.08mg/kg; Trifloxystrobin (1) 0.01mg/kg; Chlormequat (27) 0.01-0.9mg/kg; Mepiquat (21) 0.01-0.6mg/kg; Glyphosate (18) 0.12-3.3mg/kg.

[3] Azoxystrobin (6) 0.03-0.2mg/kg; Cyproconazole (4) 0.02-0.06mg/kg; Epoxiconazol (7) 0.01-0.08mg/kg; Fluxapyroxad (1) 0.01mg/kg; Prothioconazole (1) 0.02mg/kg; Tebuconazole (5) 0.04-0.3mg/kg; Chlormequat (26) 0.01-12mg/kg; Mepiquat (6) 0.01-0.8mg/kg; Glyphosate (8) 0.6-2.4mg/kg.

[4] Chlormequat (1) 0.1mg/kg; Mepiquat (1) 0.09mg/kg; Glyphosate (1) 3.0mg/kg.

[5] Glyphosate (3) 0.2-0.9mg/kg (not tested for other pesticides).

[6] Glyphosate (7) 0.2-4.5mg/kg (not tested for other pesticides).

[7] Glyphosate (8) 0.2-5.8mg/kg (not tested for other pesticides).

Table 13. Pesticides Harvest Additional Compounds 2018

	No. of Samples Analysed	% > LOD	Single Pesticide Incidence % > LOD	Multiple Pesticide Incidence % > LOD
Milling Wheat [1]	50	42%	30%	12%
Malting Barley [2]	40	18%	13%	5%
Food Oats [3]	29	28%	14%	14%
Barley	1	0%	0%	0%

[1] BAC12 (1) 0.05mg/kg; **Chlorpropham (4) 0.01-0.03mg/kg**; Chlorpyrifos-methyl (2) 0.01-0.02mg/kg; Cypermethrin (2) 0.2-0.3mg/kg; **DDAC (1) 0.3mg/kg**; Deltamethrin (2) 0.02mg/kg; Fluroxypyr (2) 0.01mg/kg; Malathion (1) 0.03mg/kg; Piperonyl butoxide (10) 0.01-0.7mg/kg; Pirimiphos-methyl (2) 0.02-0.05mg/kg; Flonicamid metabolite TFNG (1) 0.1mg/kg.

[2] Chlorpyrifos-methyl (1) 0.03mg/kg; Deltamethrin (2) 0.1-0.4mg/kg; Piperonyl butoxide (5) 0.01-1.3mg/kg; Pyraclostrobin (1) 0.02mg/kg.

[3] 2,4-D (1) 0.01mg/kg; **Chlorpropham (1) 0.01mg/kg;** Chlorpyrifos-methyl (2) 0.01-0.03mg/kg; Deltamethrin (2) 0.1-0.4mg/kg; Pencycuron (1) 0.01mg/kg; Piperonyl butoxide (3) 0.01-0.3mg/kg; Pirimiphos-methyl (2) 0.01-0.02mg/kg; Pyraclostrobin (1) 0.03mg/kg.

4 residues of chlorpropham were detected in milling wheat samples. The maximum residue level (MRL) is set at 0.01 mg/kg in wheat.

1 residues of chlorpropham was detected in food oats sample. The maximum residue level (MRL) is set at 0.01 mg/kg in oat.

1 residue of DDAC (didecyldimethylammonium chloride) was detected at 0.3mg/kg in milling wheat sample. The maximum residue level (MRL) is set at 0.1 mg/kg for this disinfectant in all foodstuff.

Table 14. Milling Wheat Metals Harvest Results 2018

	No. of Samples Analysed	% > LOD	Minimum Level mg/kg	Maximum Level mg/kg	Mean Level mg/kg	Mode Level mg/kg	Median Level mg/kg
Al	50	96%	0.6	32	6.0	3.1	3.1
Ni	50	100%	0.02	0.32	0.2	0.13	0.16
Cu	50	100%	2.2	5.2	3.6	3.7	3.7
As	50	30%	<0.01	0.08	0.02	0.01	0.01
Cd	50	98%	<0.01	0.10	0.04	0.04	0.04
Hg	50	0%	<0.01	<0.01	<0.01	<0.01	<0.01
Pb	50	28%	<0.01	0.03	0.02	0.01	0.01

Table 15. Pesticides Stored Sample Results 2018-2019

	No. of Samples Analysed	% > LOD	Single Pesticide Incidence % > LOD	Multiple Pesticide Incidence % > LOD
Malting Barley [1]	20	30%	30%	0%
Malt [2]	20	20%	20%	0%

[1] Deltamethrin (6) 0.01-0.2mg/kg.

[2] Deltamethrin (4) 0.07-0.2mg/kg.

Table 16. Pesticides Stored Additional Compounds 2018-2019

	No. of Samples Analysed	% > LOD	Single Pesticide Incidence % > LOD	Multiple Pesticide Incidence % > LOD
Malting Barley [1]	20	40%	35%	5%
Malt [2]	20	35%	30%	5%

[1] Cyprodinil (1) 0.05mg/kg; Piperonyl butoxide (8) 0.02-1.6mg/kg.

[2] Bixafen (1) 0.01mg/kg; Cyprodinil (1) 0.04mg/kg; Piperonyl butoxide (6) 0.02-0.3mg/kg.

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Table 17. Field Mycotoxins Stored Sample Results 2018-2019

	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	20	15%	<10	17.1	1.9	<10	<10
Malt	20	5%	<10	41.4	2.1	<10	<10
Deoxynivalenol-3-Glucoside							
Malting Barley	20	15%	<10	18.7	2.1	<10	<10
Malt	20	15%	<10	18.0	2.0	<10	<10
T-2-b3-Glucoside							
Malting Barley	20	10%	<10	41.6	2.7	<10	<10
Malt	20	0%	<10	<10	<10	<10	<10
HT-2 +T2							
Malting Barley	20	80%	<20	121	31.0	<20	21.7
Malt	20	15%	<20	20.7	2.2	<20	<20
NIV							
Malting Barley	20	15%	<50	95.1	10.5	<50	<50
Malt	20	20%	<50	107	14.7	<50	<50
Neosolaniol							
Malting Barley	20	5%	<10	12.2	0.6	<10	<10
Malt	20	0%	<10	<10	<10	<10	<10

**** Reporting limits vary by toxin due to individual response of each toxin.

Table 18. Ochratoxin A Stored Sample Results 2018-2019

	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
Malting Barley	20	5%	<0.2	6.3	0.3	<0.2	<0.2
Malt	20	5%	<0.2	0.3	<0.2	<0.2	<0.2

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Table 19. Acrylamide Stored Sample Results 2018-2019

	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
Malt	20	15%	<30	1765	96.2	<30	<30

Table 20. Chlorpropham Stored Sample Results 2019

	No. of Samples Analysed	% > LOD	Minimum Level mg/kg	Maximum Level mg/kg	Mean Level mg/kg	Mode Level mg/kg	Median Level mg/kg
Milling Wheat	25	0%	<0.01	<0.01	<0.01	<0.01	<0.01

Table 21. Pesticides Stored Additional Compounds 2019

	No. of Samples Analysed	% > LOD	Single Pesticide Incidence % > LOD	Multiple Pesticide Incidence % > LOD
Milling Wheat	25	16%	16%	0%
Chlorpyrifos-methyl (1) 0.047mg/kg; Deltamethrin (3) 0.02-0.2mg/kg.				

Table 22. Ochratoxin A Stored Sample Results 2019

	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 (January)	25	16%	<0.2	2.8	0.2	<0.2	<0.2
Feed Wheat	40	15%	<0.2	72.5	1.9	<0.2	<0.2
Wheat Feed	10	60%	<0.2	5.4	1.1	<0.2	0.3
Feed Barley	30	13%	<0.2	28.4	1.6	<0.2	<0.2
Food Oats	30	7%	<0.2	4.8	0.2	<0.2	<0.2
Feed Oats	10	20%	<0.2	13.3	1.4	<0.2	<0.2
Oatfeed	10	80%	<0.2	1.9	0.7	0.8	0.8

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Table 23. Pesticides Stored Sample Results 2019

	No. of Samples Analysed	% > LOD	Single Pesticide Incidence % > LOD	Multiple Pesticide Incidence % > LOD
Milling Wheat [1]	25	20%	20%	0%
Food Oats [2]	30	3%	3%	0%
Feed Wheat [3]	40	18%	18%	0%
Feed Barley [4]	30	27%	24%	3%
Wheatfeed [5]	10	60%	0%	60%
Feed Oats [6]	10	50%	30%	20%
Oatfeed [7]	10	60%	20%	40%

[1] Chlorpyrifos-methyl (1) 0.03mg/kg; Cypermethrin (1) 0.4mg/kg; Deltamethrin (1) 0.01mg/kg; Pirimiphos-methyl (2) 0.01-1.1mg/kg.

[2] Pirimiphos-methyl (1) 1.0mg/kg

[3] Chlorpyrifos-methyl (1) 0.01mg/kg; Deltamethrin (5) 0.02-0.2mg/kg; Pirimiphos-methyl (1) 0.01mg/kg.

[4] Chlorpyrifos-methyl (3) 0.05-0.1mg/kg; Deltamethrin (1) 0.04mg/kg; Pirimiphos-methyl (5) 0.01-1.6mg/kg.

[5] **Chloropropham (2) 0.02-0.04mg/kg**; **Chlorpyrifos-methyl (4) 0.02-0.2mg/kg**; Cypermethrin (3) 0.09-0.6mg/kg; Deltamethrin (5) 0.01-0.2mg/kg; Malathion (1) 0.01mg/kg; Pirimiphos-methyl (3) 0.01-0.6mg/kg.

[6] Chloropropham (1) 0.2mg/kg; **Chlorpyrifos-methyl (1) 0.02mg/kg**; Deltamethrin (3) 0.02-0.04mg/kg; Pirimiphos-methyl (2) 0.01-1.8mg/kg.

[7] Chlorpyrifos-methyl (2) 0.01-0.02mg/kg; Deltamethrin (4) 0.02-0.1mg/kg; Pirimiphos-methyl (5) 0.02-0.2mg/kg.

2 residues of chlorpropham were detected in wheatfeed samples. The maximum residue level (MRL) is set at 0.01 mg/kg in wheat.

1 residue of chlorpyrifos-methyl was detected in wheatfeed sample. The maximum residue level (MRL) is set at 0.05 mg/kg in wheat.

1 residue of chlorpyrifos-mehyl was detected in feed oats sample. The maximum residue level (MRL) is set at 0.01 mg/kg in oat.

Table 24. Pesticides Stored Additional Compounds

	No. of Samples Analysed	% > LOD	Single Pesticide Incidence % > LOD	Multiple Pesticide Incidence % > LOD
Milling Wheat [1]	25	64%	36%	28%
Food Oats [2]	30	50%	27%	23%
Feed Wheat [3]	40	73%	45%	28%
Feed Barley [4]	30	30%	20%	10%
Wheatfeed [5]	10	100%	30%	70%
Feed Oats [6]	10	70%	30%	40%
Oatfeed [7]	10	50%	0%	50%

[1] 2,4-D (1) 0.02mg/kg; Boscalid (4) 0.02-0.06mg/kg; Piperonyl butoxide (4) 0.01-0.8mg/kg; Tebuconazole (14) 0.01-0.1mg/kg.

[2] Azoxystrobin (4) 0.02-0.1mg/kg; Epoxiconazole (8) 0.01-0.08mg/kg; Kresoxim-methyl (1) 0.01mg/kg; Prothioconazole-desthio (1) 0.01mg/kg; Tebuconazole (9) 0.01-0.1mg/kg.

[3] Azoxystrobin (3) 0.01mg/kg; BAC12 (1) 0.09mg/kg; Boscalid (2) 0.02-0.09mg/kg; Fluxapyroxad (3) 0.01-0.02mg/kg; Piperonyl butoxide (9) 0.01-1.7mg/kg; Tebuconazole (24) 0.01-0.1mg/kg.

[4] Azoxystrobin (1) 0.09mg/kg; Bixafen (1) 0.02mg/kg; Fluroxypyr (1) 0.05mg/kg; Fluxapyroxad (1) 0.04mg/kg; Piperonyl butoxide (5) 0.01-0.3mg/kg; Pyraclostrobin (1) 0.01mg/kg; Pyrimethanil (1) 0.01mg/kg; Tebuconazole (1) 0.03mg/kg.

[5] 2,4-D (1) 0.03mg/kg; Azoxystrobin (3) 0.01mg/kg; Epoxiconazole (1) 0.01mg/kg; Piperonyl butoxide (9) 0.03-3.7mg/kg; Tebuconazole (8) 0.02-0.07mg/kg.

[6] Azoxystrobin (2) 0.04mg/kg; Epoxiconazole (2) 0.01-0.08mg/kg; Kresoxim-methyl (1) 0.02mg/kg; Piperonyl butoxide (3) 0.09-0.3mg/kg; Tebuconazole (3) 0.01-0.07mg/kg.

[7] Azoxystrobin (5) 0.02-0.03mg/kg; Cyproconazole (3) 0.01-0.02mg/kg; Epoxiconazole (4) 0.01-0.02mg/kg; Piperonyl butoxide (5) 0.01-0.9mg/kg; Tebuconazole (3) 0.02-0.06mg/kg.