Annual Project Report
August 2021 to June 2022

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 2024

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 that they are safe for consumption as food and feed.

Key messages emerging from the project

- During the period August 2021 to June 2022, the project focussed on monitoring of harvest and stored grain samples for trichothecenes, zearalenone, ochratoxin A and pesticides. Subsets of samples were also analysed for ergot alkaloids, aflatoxins, metals and chlorate/perchlorate. The samples analysed were 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 the previous 5 years of this study are available on the AHDB website: https://ahdb.org.uk/monitoring-of-contaminants-in-uk-cereals-used-for-processing-food-and-animal-feed. Selected results from 2021 are presented below.
- **Harvest samples mycotoxins** – The mean DON levels found were low and were similar to those found in 2020 and 2019. No sample exceeded the maximum level (ML). The maximum DON level found was 2581 µg/kg in an oatfeed, 100% of oatfeed contained DON above the reporting limit (RL). Other cereals with 100% incidence above the RL were feed oats, wheatfeed and food barley, although there was only one sample of this. Incidence above the RL ranged from 55% for food oats to 90% for milling wheat. Comparing mean results over 2019, 2020 and 2021, in general, DON levels were similar for milling wheat, feed oats and malting barley. Mean DON levels in malting barley, feed wheat and food oats were lower in 2021 than 2020. For the other products, the mean DON levels were higher in 2021. For wheatfeed, the mean was 378 µg/kg compared to 204 µg/kg in 2020, and for

oatfeed, the mean was 638 µg/kg compared to 365 µg/kg in 2020. A summary of the mean DON levels in fresh harvest samples over the duration of the project is given in Figure 1.

- Incidence of NIV above the RL ranged from 2% (milling wheat) to 100% (oatfeed and food barley). There was only one food barley sampley and it contained 850 µg/kg nivalenol. There are no maximum levels for this mycotoxin. For the other products, the highest mean level (182 µg/kg) was found in feed oats. Oatfeed and feed barley had similar mean levels of 169 and 165 µg/kg, respectively. The highest maximum level (888 µg/kg) was found in a sample of malting barley, the incidence in this product was low (40%), the mean level found was 60 µg/kg.
- A small number of samples contained 3-acetyl DON, the maximum level found was 228 µg/kg in oatfeed, food oats and feed oats were the only other products that contained 3-acetyl DON above the RL. Two samples contained a very low level of 15-acetyl DON, a milling wheat at 23.9 µg/kg and a feed barley at 27 µg/kg. Neosolaniol was measured above the RL in food oats (48%), feed oats (50%) and oatfeed (100%), with mean levels of 40, 14.3 and 110 µg/kg, respectively. Fusarenon X and diacetoxyscirpenol were not found above the RL in any of the samples.
- In 2021, T-2 and HT-2 toxins were detected most frequently in oats (food and feed) and oatfeed, 100% oatfeed, food oats and feed oats, as well as the single food barley sample, contained T-2 and HT-2 above the RL. The highest levels were also found in these products. The maximum levels found were: 4734 µg/kg in oatfeed, food oats (1030 µg/kg) and 337 µg/kg in feed oats. The mean level found in food oats was 351 µg/kg (similar to 2020, lower than 2019) and for feed oats was 213 µg/kg (again similar to 2020 but lower than 2019). There are no maximum levels in force for T-2 and HT-2, although limits are being discussed in Europe, the mean values for all products would comply with the levels under discussion. Over the six years of the study, there has been little incidence of T-2 and HT-2 toxins above the RL in wheat products, the highest incidence was 83% in wheatfeed this year, the maximum level found was 38 µg/kg. Mean levels in these products have generally been below the RL. A summary of the mean T-2 and HT-2 toxins levels in fresh harvest samples over the duration of the project is given in Figure 2.
- The highest zearalenone (ZEN) level found in any sample was 353 µg/kg in a feed wheat. The incidence in feed wheat was 53% and the mean level was 36.6 µg/kg. The highest incidences of ZEN were in wheatfeed (94%) and oatfeed (67%). The

maximum level in wheat feed was 60 µg/kg, with a mean of 19.4 µg/kg, while for oatfeed the maximum level was 134 µg/kg and the mean level was 29.2 µg/kg. A maximum level of 115 µg/kg was found in a milling wheat sample. This was above the ML but was not an exceedance when measurement uncertainty was taken into account. The incidence above the RL was 35% in milling wheat, with a mean level of 5.8 µg/kg. A summary of the mean ZEN levels in fresh harvest samples over the duration of the project is given in Figure 3.

- Masked forms of deoxynivalenol, T-2 toxin and zearalenone were also analysed. Deoxynivalenol 3-glucoside (DON3G) was found mainly in oatfeed and wheatfeed samples. Incidence above the RL ranged from 33% (oats and malting barley) to 100% (wheatfeed and food barley). The mean levels ranged from less than the reporting limit to 66.4 µg/kg (oatfeed). The highest levels found were 219 and 218 µg/kg in wheatfeed and feed barley, respectively. T-2 glucoside was detected in oats and oatfeed samples plus a small incidence in barley samples. The mean level found in oatfeed was 188 µg/kg and the maximum level found was 424 µg/kg (compared to 118 µg/kg and 205 µg/kg in 2020). This was the highest maximum level found. For food oats the mean value found was 53 µg/kg (compared to 37 µg/kg in 2020) and the maximum value found was 232 µg/kg (compared to 205 µg/kg in 2020). One sample of milling wheat contained a low level (3.2 µg/kg) of a modified form of zearalenone (β-zearalenol). Five samples of feed wheat contained α-zearalenol or β-zearalenol, the highest level was 9.5 µg/kg β-zearalenol. None of the other modified forms were detected about the reporting limit in any other samples this year.
- Incidence of ergot alkaloids ranged from 14% in food oats to 100% in wheatfeed, feed oats and oatfeed. The one sample of food barley did not contain ergot alklaoids. The highest maximum level was found in feed barley (6037 µg/kg), although the mean level was 466 µg/kg. Feed barley also had the highest mean level but this was largely caused by the sample with the high level as the median level for was 17 µg/kg, with an incidence of 93%. The next highest maximum level was found in milling wheat (2603 µg/kg), again the mean (213 µg/kg) and median levels (<6.0 µg/kg) were much lower. Wheatfeed had a maximum level of 1119 µg/kg, mean of 454 µg/kg and median of 340 µg/kg. For food oats, the highest maximum level was 232 µg/kg, but the mean level was only 10.3 µg/kg. The mean levels in all other products were low (from 17.2 to 80 µg/kg for sum ergot alkaloids). Regulation (EU) 2021/1399 introduced maximum levels for ergot

alkaloids in some cereal products for human consumption. These levels came into force in the EU on 1st July 2022, but do not apply in GB.

- **Metals analysis –** subsets of food oats, milling wheat and malting barley were analysed for aluminium, nickel, copper, arsenic, cadmium, mercury and lead. Mercury was not detected in any of the samples. Very low levels of arsenic were detected in a small number of samples (incidence was 20-30%), maximum level found was 0.07 mg/kg in a milling wheat. There was also a low incidence of lead (32-50%), the maximum level found was 0.12 mg/kg. Cadmium was detected in the majority of samples. No sample contained any metal above the maximum level. Data was also obtained for copper, nickel and aluminium, this provided supporting information on the occurrence of these elements in cereals.
- **Stored Samples Mycotoxins** - Wheatfeed (92%) and oatfeed (100%) most frequently contained ochratoxin A (OTA). The highest level, 49.7 µg/kg, was found in a feed barley, but this was atypical as the mean level for feed barley was 1.4 µg/kg and the median was <0.2 µg/kg. A sample of food oats contained 17.2 µg/kg, which exceeded the ML for ochratoxin A (OTA), this was one of only two samples of food oats that contained OTA, the other sample contained 0.4 µg/kg. A sample of malt contained 6.2 µg/kg, this was an exceedance of the ML for processed cereals of 3 µg/kg; however, this maximum level does not apply to malt. Feed wheat, feed barley, food oats and milling wheat had the lowest incidence of OTA. Mean levels across all samples ranged from <0.2 to 1.4 µg/kg.
- Ten matched pairs of malt and malting barley were analysed for aflatoxins. Overall incidence of aflatoxins was very low, the maximum level found was 0.2 µg/kg aflatoxin B1 in a small number of samples. Incidence was 10% in malting barley and 40% in malt.
- Matched pairs of malting barley and malt were also analysed for Fusarium mycotoxins. DON and DON3G were found most frequently, 45% of malting barley and 30% of malt contained DON, and 55% of malting barley and 95% of malt contained DON3G. The maximum level was 347 µg/kg DON3G in a malt, mean levels of DON were 22.1 and 13.3 µg/kg for malting barley and malt, respectively and 16.8 and 63.5 µg/kg for DON3G in malting barley and malt, respectively.

- **Pesticides** - One sample of milling wheat contained a residue of chlorpropham at 0.032 mg/kg. The maximum residue level (MRL) is set at 0.01* mg/kg for

chlorpropham in wheat. The residue is above the MRL and is still an exceedance if measurement uncertainty (±50%) is taken into account.

- One sample of malt contained a residue of chlorate at 1.1 mg/kg. The maximum residue level (MRL) is set at 0.05 mg/kg for chlorate in wheat. The residue is above the MRL and is still an exceedance if measurement uncertainty (±50%) is taken into account.
- 105 samples contained residues of plant growth regulator chlormequat and 46 samples contained mepiquat. None of these residues exceeded their corresponding MRLs.
- A high incidence of residues (72) was found for glyphosate, which is used as a desiccant. None of these residues exceeded their corresponding MRLs.
- Other most frequently found residues were for synergist piperonyl butoxide (58), fungicide tebuconazole (46) and insecticide deltamethrin (24). None of these residues exceeded their corresponding MRLs. No MRL is set for piperonyl butoxide.
- Other than the two samples with chlorpropham and chlorate residues above, no other samples contained any residue above their corresponding MRLs.
- 160 residues were detected in feed or crops to be used for animal feed. No MRLs are currently applicable for “products or part of products exclusively used for animal feed production”.
- The chart below (Figure 5) shows the distribution of 438 residues detected in the 377 samples tested. 83 samples (22%) contained no residues and 294 samples (78%) of the samples contained between 1 and 5 residues.

Figure 1. Mean DON levels in harvest samples (µg/kg)

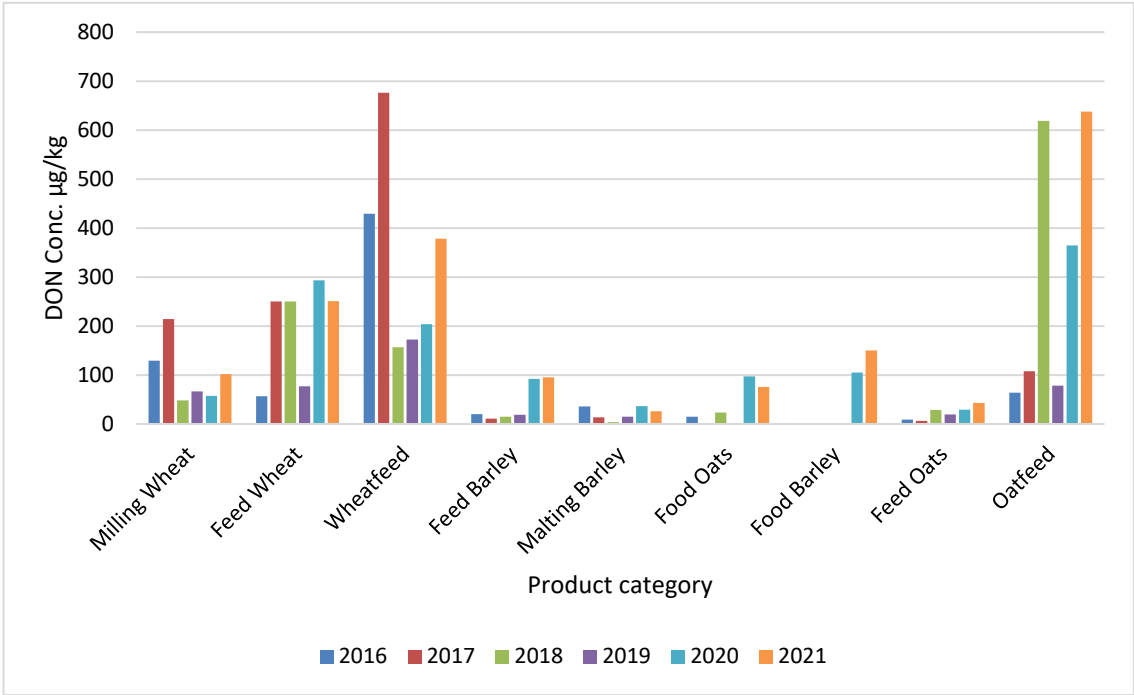
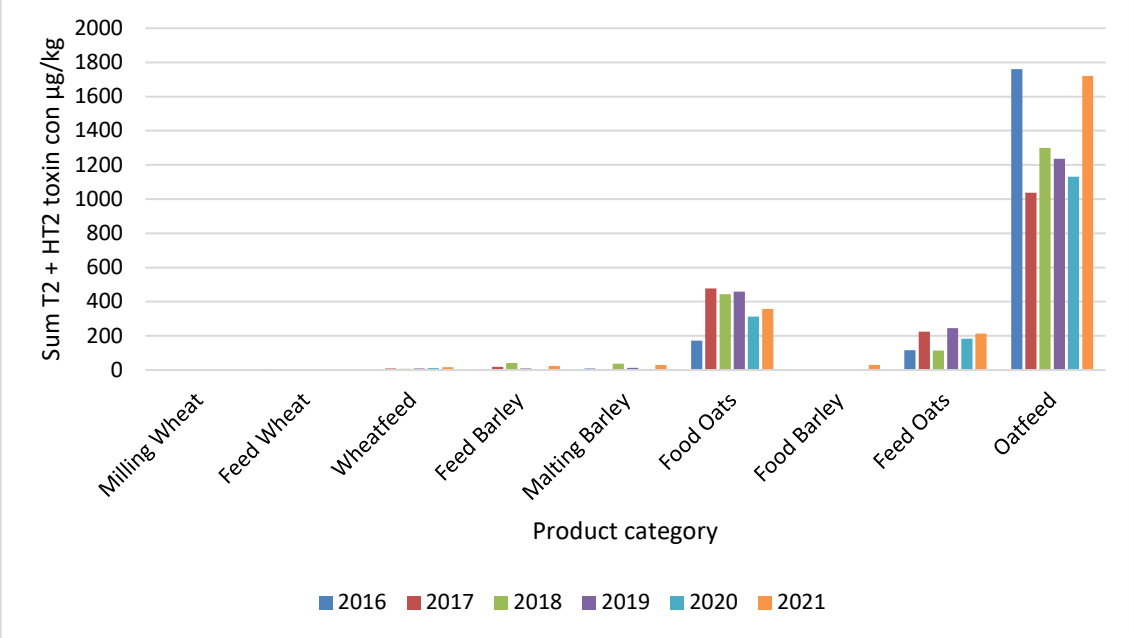


Figure 2. Mean T-2 and HT-2 toxins levels in Harvest samples (µg/kg)



The results described in this summary report are interim and relate to one year, except where stated. In all cases, the reports refer to projects that extend over a number of years.

Figure 3. Mean ZEN levels in harvest samples (µg/kg)

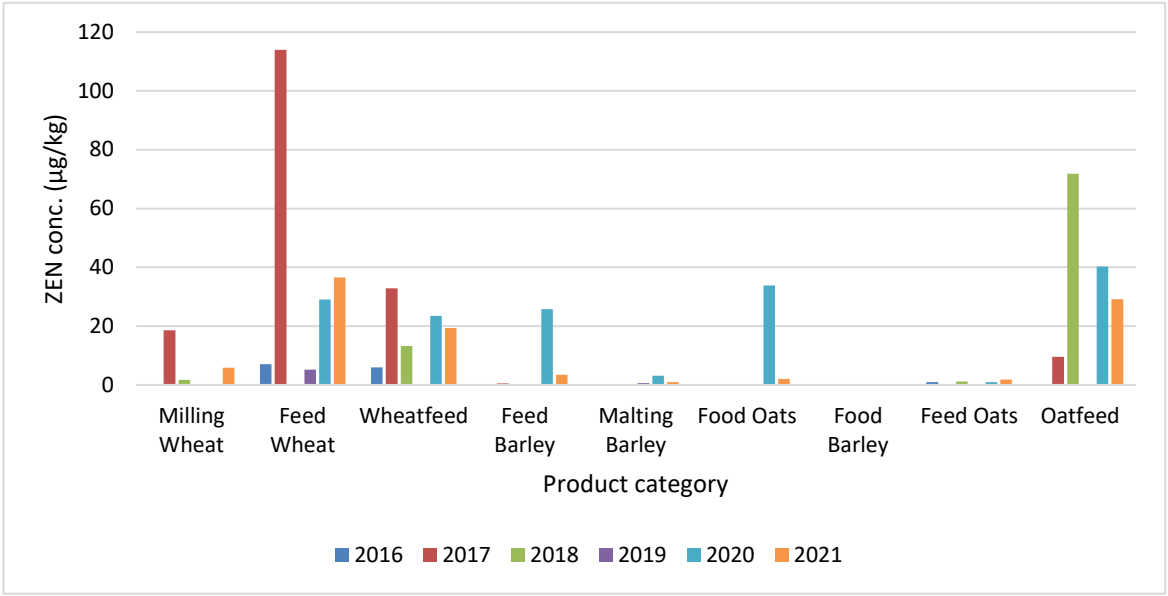


Figure 4. Mean sum ergot alkaloid levels in harvest samples (µg/kg)

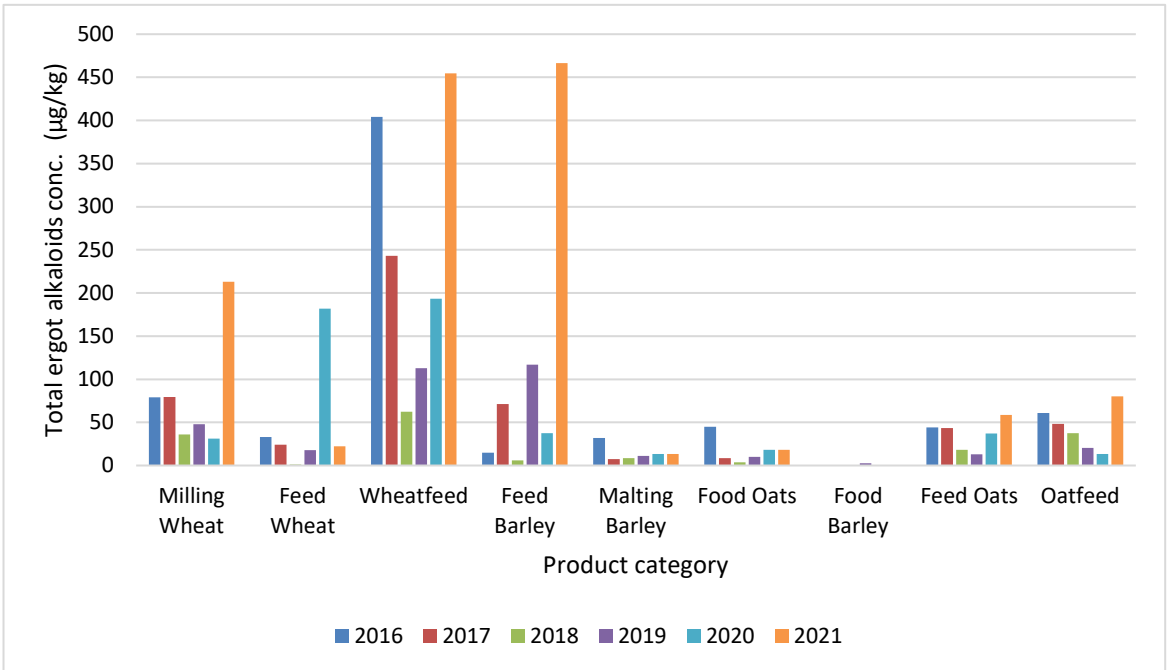


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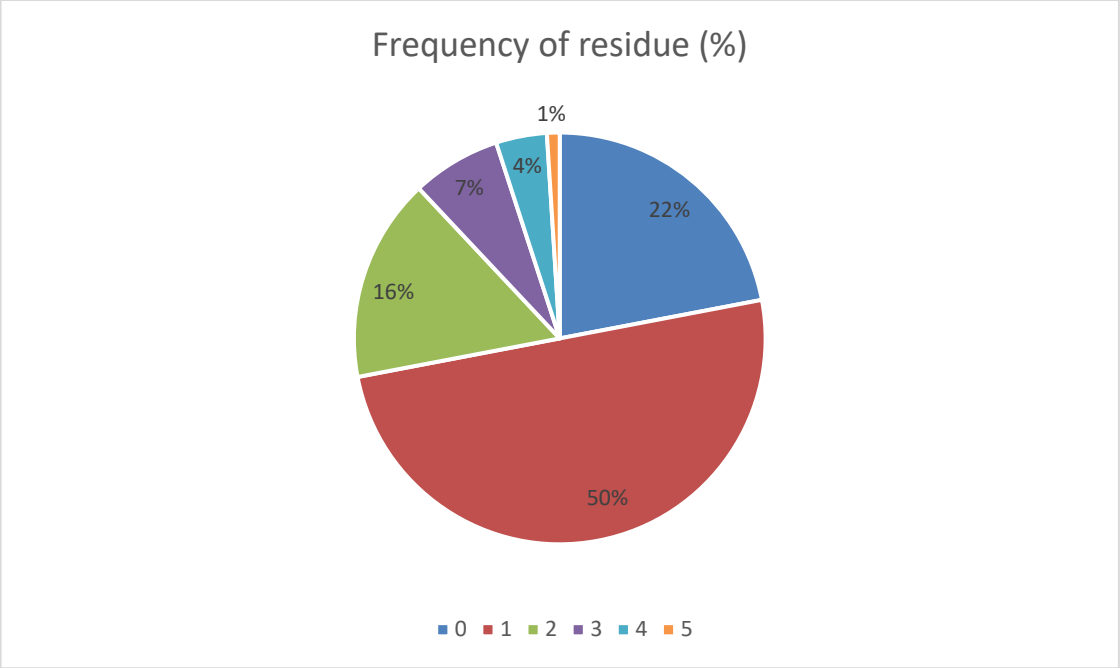
Figure 5. Summary of pesticides residues



Summary of results from the reporting year

All analyses, were carried out using UKAS ISO17025 accredited methods. All data calculations presented in the following tables are reported as 'lower bound' values, i.e. any result less than the reporting limit has been presumed to be zero.
Results for key mycotoxins are shown below.
The minimum level recorded in the tables is the reporting limit, or the lowest measured value where 100% of samples contained a measurable level of analyte.

Table 1. Deoxynivalenol Harvest Results 2021

	No. of Samples Analysed	% > Reporting Limit	Minimum Level µg/kg	Maximum Level µg/kg	2021 Mean Level µg/kg	Median Level µg/kg
Milling Wheat	51	90%	<10	620	102	60.6
Feed Wheat	15	80%	<10	1414	251	95.2
Wheatfeed	18	100%	185	1485	378	289
Feed Barley	15	67%	<10	790	95.5	29.9
Malting Barley	40	60%	<10	201	26	12
Food Oats	29	55%	<10	746	76	12
Food Barley	1	100%	150	150	150	150
Feed Oats	6	100%	15	120	43.1	28.4
Oatfeed	6	100%	21.3	2581	638	43.5

Table 2. Nivalenol Harvest Results 2021

	No. of Samples Analysed	% > Reporting Limit	Minimum Level µg/kg	Maximum Level µg/kg	Mean Level µg/kg	Median Level µg/kg
Milling Wheat	51	2%	<50	122.7	2.4	<50
Feed Wheat	15	20%	<50	68.2	12.1	<50
Wheatfeed	18	72%	<50	250	59.9	61.2
Feed Barley	15	60%	<50	450	165	147
Malting Barley	40	40%	<50	888	60	<50
Food Oats	29	72%	<50	841	136	93
Food Barley	1	100%	850	850	850	850
Feed Oats	6	83%	<50	341	182	190
Oatfeed	6	100%	140	225	169	162

Table 3. 3Acetyl-Deoxynivalenol Harvest Results 2021

	No. of Samples Analysed	% > Reporting Limit	Minimum Level µg/kg	Maximum Level µg/kg	Mean Level µg/kg	Median Level µg/kg
Milling Wheat	51	0%	<10	<10	<10	<10
Feed Wheat	15	0%	<10	<10	<10	<10
Wheatfeed	18	0%	<10	<10	<10	<10
Feed Barley	15	0%	<10	<10	<10	<10
Malting Barley	40	0%	<10	<10	<10	<10

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Food Oats	29	14%	<10	70	5	<10
Food Barley	1	0%	<10	<10	<10	<10
Feed Oats	6	17%	<10	10.4	1.7	<10
Oatfeed	6	33%	<10	228	49.9	<10

Table 4. 15Acetyl-Deoxynivalenol Harvest Results 2021

	No. of Samples Analysed	% > Reporting Limit	Minimum Level µg/kg	Maximum Level µg/kg	Mean Level µg/kg	Median Level µg/kg
Milling Wheat	51	2%	<20	23.9	0.5	<20
Feed Wheat	15	0%	<20	<20	<20	<20
Wheatfeed	18	0%	<20	<20	<20	<20
Feed Barley	15	7%	<20	27	1.8	<20
Malting Barley	40	0%	<40	<20	<20	<20
Food Oats	29	0%	<40	<40	<40	<40
Food Barley	1	0%	<40	<40	<40	<40
Feed Oats	6	0%	<20	<20	<20	<20
Oatfeed	6	0%	<20	<20	<20	<20

Table 5. Neosolaniol Harvest Results 2021

	No. of Samples Analysed	% > Reporting Limit	Minimum Level µg/kg	Maximum Level µg/kg	Mean Level µg/kg	Median Level µg/kg
Milling Wheat	51	0%	<10	<10	<10	<10
Feed Wheat	15	0%	<10	<10	<10	<10
Wheatfeed	18	0%	<10	<10	<10	<10
Feed Barley	15	0%	<10	<10	<10	<10
Malting Barley	40	0%	<10	<10	<10	<10
Food Oats	29	48%	<10	40	11	<10
Food Barley	1	0%	<10	<10	<10	<10
Feed Oats	9	50%	<10	14.3	6.5	<10
Oatfeed	6	100%	33.9	110	52.3	42.4

Table 6. HT-2 + T-2 Harvest Results 2021

	No. of Samples Analysed	% > Reporting Limit	Minimum Level µg/kg	Maximum Level µg/kg	Mean Level µg/kg	Median Level µg/kg
Milling Wheat	51	4%	<20	43.0	1.2	<20
Feed Wheat	15	0%	<20	<20	<20	<20
Wheatfeed	18	83%	<20	38.0	15.8	16.0
Feed Barley	15	53%	<20	143	24.9	<20
Malting Barley	40	50%	<20	302	20	<20
Food Oats	29	100%	60	1030	351	264
Food Barley	1	100%	31	31	31	31
Feed Oats	6	100%	20	337	213	262
Oatfeed	6	100%	814	4734	1722	937

Table 7. Zearalenone Harvest Results 2021

	No. of Samples Analysed	% > Reporting Limit	Minimum Level µg/kg	Maximum Level µg/kg	Mean Level µg/kg	Median Level µg/kg
Milling Wheat	51	35%	<2.5	115.0	5.8	<2.5
Feed Wheat	15	53%	<2.5	353	36.6	2.7
Wheatfeed	18	94%	<2.5	60	19.4	19.4
Feed Barley	15	33%	<2.5	22	3.5	<2.5
Malting Barley	40	8%	<2.5	11	1	<2.5
Food Oats	29	28%	<2.5	33	2	<2.5
Food Barley	1	0%	<2.5	<2.5	<2.5	<2.5
Feed Oats	6	33%	<2.5	7.4	1.8	<2.5
Oatfeed	6	67%	<2.5	134	29.2	6.8

Table 8. Deoxynivalenol-3-Glucoside Harvest Results 2021

	No. of Samples Analysed	% > Reporting Limit	Minimum Level µg/kg	Maximum Level µg/kg	Mean Level µg/kg	Median Level µg/kg
Milling Wheat	51	53%	<10	59.1	11.7	10.8
Feed Wheat	15	53%	<10	195	34.4	13.7
Wheatfeed	18	100%	17.2	219	41.5	28.9
Feed Barley	15	60%	<10	218	28.8	14.5
Malting Barley	40	33%	<10	72	8	<10

Food Oats	29	34%	<20	72	12	<20
Food Barley	1	100%	46.0	46.0	46.0	46.0
Feed Oats	6	33%	<10	22.9	5.9	<10
Oatfeed	6	67%	<10	285	66.4	12.1

Table 9. T-2-α3-Glucoside Harvest Results 2021

	No. of Samples Analysed	% > Reporting Limit	Minimum Level µg/kg	Maximum Level µg/kg	Mean Level µg/kg	Median Level µg/kg
Milling Wheat	51	0%	<10	<10	<10	<10
Feed Wheat	15	0%	<10	<10	<10	<10
Wheatfeed	18	0%	<10	<10	<10	<10
Feed Barley	15	13%	<10	218	28.8	14.5
Malting Barley	40	8%	<10	26	1	<10
Food Oats	29	79%	<10	232	53	36
Food Barley	1	0%	<10	<10	<10	<10
Feed Oats	6	83%	<10	77	37.7	<10
Oatfeed	6	100%	131	424	188	143

Table 10. Total Ergot Alkaloids (n=12) Harvest Results 2021

	No. of Samples Analysed	% > Reporting Limit	Minimum Level µg/kg	Maximum Level µg/kg	Mean Level µg/kg	Median Level µg/kg
Milling Wheat	51	76%	<6.0	2603	213	<6.0
Feed Wheat	15	80%	<6.0	123	22	1.4
Wheatfeed	18	100%	86.8	1119	454	340
Feed Barley	15	93%	<6.0	6037	466	17.0
Malting Barley	40	55%	<6.0	236	17.2	0.7
Food Oats	29	14%	<6.0	232	10.3	<6.0
Food Barley	1	0%	<6.0	<6.0	<6.0	<6.0
Feed Oats	6	100%	<6.0	151	58.7	45.1
Oatfeed	9	100%	<6.0	187	80.0	69.3

** 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, of 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.

Table 11. Metals in Milling Wheat Results Harvest 2021

	No. of Samples Analysed	% > Reporting Limit	Minimum Level mg/kg	Maximum Level mg/kg	Mean Level mg/kg	Median Level mg/kg
Aluminium	25	96	<0.5	94.4	11.5	5.2
Nickel	25	100	0.1	1.34	0.27	0.20
Copper	25	100	2.8	5.7	3.7	3.6
Arsenic	25	28	<0.01	0.07	0.01	<0.01
Cadmium	25	100	<0.01	0.09	0.04	0.04
Mercury	25	0	<0.01	<0.01	<0.01	<0.01
Lead	25	32	<0.01	0.12	0.01	<0.01

Table 12. Metals in Food Oats Results Harvest 2021

	No. of Samples Analysed	% > Reporting Limit	Minimum Level mg/kg	Maximum Level mg/kg	Mean Level mg/kg	Median Level mg/kg
Aluminium	10	100	0.7	148.9	20.0	2.5
Nickel	10	100	2.62	8.35	4.90	4.47
Copper	10	100	2.2	3.6	3.0	3.1
Arsenic	10	30	<0.01	0.06	0.02	<0.01
Cadmium	10	70	<0.01	0.03	0.01	0.01
Mercury	10	0	<0.01	<0.01	<0.01	<0.01
Lead	10	50	<0.01	0.08	0.02	0.01

Table 13. Metals in Malting Barley Results Harvest 2021

	No. of Samples Analysed	% > Reporting Limit	Minimum Level mg/kg	Maximum Level mg/kg	Mean Level mg/kg	Median Level mg/kg
Aluminium	10	100	1.2	32.9	7.9	5.6
Nickel	10	100	0.22	0.94	0.56	0.58
Copper	10	100	2.5	4.7	3.8	3.7
Arsenic	10	20	<0.01	0.02	0.01	<0.01
Cadmium	10	70	<0.01	0.01	0.01	0.01
Mercury	10	0	<0.01	<0.01	<0.01	<0.01
Lead	10	40	<0.01	0.03	0.01	<0.01

Table 14. Ochratoxin A Stored Sample Results 2022

	No. of Samples Analysed	% > Reporting Limit	Minimum Level µg/kg	Maximum Level µg/kg	Mean Level µg/kg	Median Level µg/kg
Malting Barley	20	10%	<0.2	1.5	0.1	<0.2
Malt	20	20%	<0.2	6.2	0.4	<0.2
Milling Wheat (January)	25	0%	<0.2	<0.2	<0.2	<0.2
Milling Wheat (March)	25	8%	<0.2	0.5	<0.2	<0.2
Feed Wheat	40	13%	<0.2	2.6	0.1	<0.2
Wheat Feed	12	92%	<0.2	3.2	1.0	<0.2
Feed Barley	36	8%	<0.2	49.7	1.4	<0.2
Food Oats	30	7%	<0.2	17.2	0.6	<0.2
Feed Oats	6	50%	<0.2	2.9	1.1	<0.2
Oatfeed	6	100%	0.3	1.5	0.9	0.95

Table 15. Field Mycotoxins Malting Barley & Malt Results 2021-2022

	No. of Samples Analysed	% > Reporting Limit	Minimum Level µg/kg***	Maximum Level µg/kg	Mean Level µg/kg	Median Level µg/kg
Deoxynivalenol						
Malting Barley	20	45%	<10	133	22.1	<10
Malt	20	30%	<10	111	13.3	<10
Deoxynivalenol-3-Glucoside						
Malting Barley	20	55%	<10	83.9	16.8	<10
Malt	20	95%	<10	347	63.5	<10
3-Acetyl Deoxynivalenol						
Malting Barley	20	0%	<10	<10	<10	<10
Malt	20	0%	<10	<10	<10	<10
15-Acetyl Deoxynivalenol						
Malting Barley	20	0%	<20	<20	<20	<20
Malt	20	10%	<20	59.6	4.3	<20
T-2-b3-Glucoside						
Malting Barley	20	5%	<10	10.8	0.5	<10
Malt	20	0%	<10	<10	<10	<10
HT-2 +T2						
Malting Barley	20	50%	<20	282	26.1	<20
Malt	20	0%	<20	<20	<20	<20
NIV						

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Malting Barley	20	25%	<50	352	33.9	<50
Malt	20	0%	<50	<50	<50	<50

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

Table 16. Aflatoxins - Malting Barley & Malt Results 2021-2022

	AFB1	AFB2	AFG1	AFG2	total
Malting Barley					
No. of Samples	10	10	10	10	10
% > LOD	10%	0%	0%	0%	10%
Minimum Level µg/kg	<0.2	<0.2	<0.2	<0.2	<0.8
Maximum Level µg/kg	0.2	<0.2	<0.2	<0.2	0.2
Mean Level µg/kg	<0.2	<0.2	<0.2	<0.2	<0.8
Median Level µg/kg	<0.2	<0.2	<0.2	<0.2	<0.8
Malt					
No. of Samples	10	10	10	10	10
% > LOD	40%	0%	0%	0%	40%
Minimum Level µg/kg	<0.2	<0.2	<0.2	<0.2	<0.8
Maximum Level µg/kg	0.2	<0.2	<0.2	<0.2	0.2
Mean Level µg/kg	0.1	<0.2	<0.2	<0.2	0.1
Median Level µg/kg	<0.2	<0.2	<0.2	<0.2	<0.8

Table 17. Pesticides Harvest Results 2021

	No. of Samples Analysed	% > Reporting Limit	Single Pesticide Incidence % > LOD	Multiple Pesticide Incidence % > LOD
Milling Wheat [1]	51	94	29	65
Malting Barley [2]	40	23	15	8
Food Oats [3]	29	97	34.5	62.1
Barley [4]	1	100	0	100
Feed Wheat [5]	15	33	33	
Feed Barley [6]	15	73	73	
Feed Oats [7]	6	67	67	

[1] chlormequat (45) 0.036-0.42 mg/kg; fluxapyroxad (1) 0.040 mg/kg; glyphosate (21) 0.13-1.2 mg/kg; mepiquat (8) 0.011-0.17 mg/kg; tebuconazole (16) 0.012-0.037 mg/kg.

[2] bixafen (3) 0.015-0.030 mg/kg; cyprodinil (2) 0.012, 0.023; epoxiconazole (1) 0.028; fluoxastrobin (2) 0.010, 0.019; fluxapyroxad (4) 0.010-0.065 mg/kg.

[3] azoxystrobin (3) 0.010, 0.016 mg/kg; bixafen (1) 0.038 mg/kg; chlormequat (21) 0.010-14 mg/kg; cyproconazole (4) 0.011, 0.042 mg/kg; glyphosate (11) 0.46-7.0 mg/kg; mepiquat (12) 0.014-1.7 mg/kg; tebuconazole (1) 0.025 mg/kg.

[4] chlormequat (1) 0.17 mg/kg; glyphosate (1) 3.5 mg/kg.

[5] Glyphosate (5) 0.13-0.61 mg/kg (not tested for other pesticides).

[6] Glyphosate (11) 0.16-15 mg/kg (not tested for other pesticides).

[7] Glyphosate (4) 0.26-5.9 mg/kg (not tested for other pesticides).

Table 18. Pesticides Harvest Additional Compounds 2021

	No. of Samples Analysed	% > LOD	Single Pesticide Incidence % > LOD	Multiple Pesticide Incidence % > LOD
Milling Wheat [1]	51	27	25	2
Malting Barley [2]	40	18	13	5
Food Oats [3]	29	10	7	3
Barley [4]	1	0	0	0
Feed Wheat [5]	10	n/a	n/a	n/a
Feed Barley [6]	10	n/a	n/a	n/a
Feed Oats [7]	10	n/a	n/a	n/a

[1] cypermethrin (1) 0.015 mg/kg; diphenylamine (2) 0.025, 0.027 mg/kg; fluopyram (2) 0.015, 0.031; fluroxypyr (2) 0.014, 0.017 mg/kg; piperonyl butoxide (7) 0.011-0.037; triallate (1) 0.017.

[2] deltamethrin (1) 0.12 mg/kg; fluroxypyr (1) 0.023 mg/kg; piperonyl butoxide (5) 0.013-0.89 mg/kg, pyraclostrobin (2) 0.012, 0.026.

[3] deltamethrin (1) 0.13 mg/kg; piperonyl butoxide (2) 0.013, 0.93 mg/kg; pyraclostrobin (1) 0.013.

[4] No additional residues detected.

[5] Glyphosate only (Not tested for other pesticides).

[6] Glyphosate only (Not tested for other pesticides).

[7] Glyphosate only (Not tested for other pesticides).

Table 19. Pesticides Malting Barley & Malt Stored Sample Results 2021-2022

	No. of Samples Analysed	% > LOD	Single Pesticide Incidence % > LOD	Multiple Pesticide Incidence % > LOD
Malting Barley [1]	20	95%	10%	85%
Malt [2]	20	95%	5%	90%

[1] chlorate (3) 0.012-0.99*mg/kg; chlormequat (19) 0.015-0.67mg/kg; deltamethrin (4) 0.042-0.19mg/kg; glyphosate (4) 0.10-0.19mg/kg; mepiquat (14) 0.018-0.33mg/kg. *Indicative result to be confirmed by duplicate re-extraction. MRL for chlorate ion in barley is set at 0.05 mg/kg.

[2]chlorate (2) 0.016, 0.034mg/kg; chlormequat (19) 0.014-0.49mg/kg; deltamethrin (5) 0.048-0.18mg/kg; glyphosate (15) 0.16-1.9mg/kg; mepiquat (12) 0.013-0.24mg/kg.

Table 20. Pesticides Malting Barley & Malt Additional Compounds Results 2021-2022

	No. of Samples Analysed	% > LOD	Single Pesticide Incidence % > LOD	Multiple Pesticide Incidence % > LOD
Malting Barley [1]	20	35%	35%	0%
Malt [2]	20	35%	55%	0%

[1] fluxapyroxad (2) 0.012, 0.036; piperonyl butoxide (5) 0.046-0.33mg/kg.

[2] fluxapyroxad (4) 0.012-0.022; piperonyl butoxide (7) 0.018-1.7mg/kg.

Table 21. Chlorpropham Stored Sample Results 2022

	No. of Samples Analysed	% > LOD	Single Pesticide Incidence % > LOD	Multiple Pesticide Incidence % > LOD
Milling Wheat	25	0%	0%	0%

Table 22. Pesticides Stored Sample Results 2022

	No. of Samples Analysed	% > LOD	Single Pesticide Incidence % > LOD	Multiple Pesticide Incidence % > LOD
Food Oats [1]	30	3%	3%	0%
Milling Wheat [2]	25	12%	12%	0%
Feed Wheat [3]	40	10%	10%	0%
Wheatfeed [4]	12	67%	42%	25%
Feed Barley [5]	36	8%	8%	0%
Feed Oats [6]	6	17%	17%	0%
Oatfeed [7]	6	0%	0%	0%

[1] 1 deltamethrin (1) 0.049mg/kg.
[2] chlorpropham (1) 0.032mg/kg; deltamethrin (2) 0.025, 0.039mg/kg. The MRL for chlorpropham in wheat is set at 0.01*mg/kg.
[3] deltamethrin (3) 0.017-0.090mg/kg; pirimiphos-methyl (1) 0.015mg/kg.
[4] cypermethrin (3) 0.012-0.13mg/kg; deltamethrin (5) 0.011-0.16mg/kg; pirimiphos-methyl (4) 0.036-1.0mg/kg.
[5] cypermethrin (1) 0.031mg/kg; deltamethrin (1) 0.026mg/kg; pirimiphos-methyl (1) 0.04mg/kg.
[6] deltamethrin (1) 0.16mg/kg.
No MRLs are set for feed or crops meant for animal feed in UK or EU

Table 23. Pesticides Stored Additional Compounds

	No. of Samples Analysed	% > LOD	Single Pesticide Incidence % > LOD	Multiple Pesticide Incidence % > LOD
Food Oats [1]	30	30%	17%	13%
Milling Wheat [2]	25	36%	32%	4%
Feed Wheat [3]	40	35%	27.5%	7.5%
Wheatfeed [4]	12	91.6%	58.3%	33.3%
Feed Barley [5]	36	36%	30.5%	5.5%
Feed Oats [6]	6	83%	66.7%	16.7%
Oatfeed [7]	6	50%	16.7%	33.3%

[1] azoxystrobin (2) 0.020, 0.026mg/kg; bixafen (2) 0.011, 0.012mg/kg; cyproconazole (1) 0.024mg/kg; fluoxastrobin (1) 0.029mg/kg; fluxapyroxad (3) 0.011-0.074mg/kg; piperonyl butoxide (2) 0.024, 0.49mg/kg; tebuconazole (5) 0.011-0.069mg/kg;
[2] fluroxypyr (1) 0.014mg/kg; piperonyl butoxide (3) 0.039-0.46mg/kg; tebuconazole (5) 0.010-0.025mg/kg; TFNG (1) 0.015 mg/kg; flonicamid sum (1) 0.014mg/kg sum of flonicamid,TFNA and TFNG expressed as flonicamid.
[3] fluxapyroxad (2) 0.019, 0.026mg/kg; piperonyl butoxide (7) 0.011-0.78mg/kg; tebuconazole (10) 0.010-0.069mg/kg.
[4] fluroxypyr (4) 0.012-0.014mg/kg; piperonyl butoxide (9) 0.021-1.8mg/kg; tebuconazole (3) 0.011-0.017mg/kg.
[5] bixafen (1) 0.010mg/kg; fluxapyroxad (5) 0.013-0.11mg/kg; piperonyl butoxide (7) 0.010-0.45mg/kg; pyraclostrobin (1) 0.025mg/kg; tebuconazole (1) 0.016mg/kg.
[6] azoxystrobin (1) 0.015mg/kg; fluroxypyr (1) 0.016mg/kg; piperonyl butoxide (3) 0.014-1.1mg/kg; tebuconazole (2) 0.029, 0.36mg/kg.
[7] azoxystrobin (1) 0.011mg/kg; cyproconazole (2) 0.012, 0.021mg/kg; piperonyl butoxide (1) 0.013mg/kg; tebuconazole (3) 0.025-0.030mg/kg.
No MRLs are set for feed or crops meant for animal feed in UK or EU.