Annual Project Report
August 2020 to June 2021

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 2022

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 2020 to June 2021, 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, metals and chlorate/perchlorate. 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 and provides supplementary information to the industry's own monitoring data. The results from the previous four years of this study are available on the AHDB website: ahdb.org.uk/monitoring-of-contaminants-in-uk-cereals-used-for-processing-food-and-animal-feed. Selected results from 2020 are presented below.
- Harvest Samples Mycotoxins – No sample exceeded the maximum level (ML). The maximum DON level found was 1575 µg/kg in a feed wheat, 100% of oatfeed, wheatfeed and food barley (1 sample) contained DON above the reporting limit (RL), incidence above the RL ranged from 45% for food oats to 90% for feed wheat. Comparing mean results with the five-year average of the project, DON levels were lower in 2020 for milling wheat and wheatfeed. All other products had higher mean levels in 2020 than the five-year average, although all were well below any MLs. Oatfeed had 100% incidence above the RL, while incidence in feed oats and food oats were 80% and 45% respectivley. The highest mean level

measured in oat products in 2020 was 365 µg/kg in oatfeed. This was also the highest mean level across all products in 2020.

- Incidence of NIV above the RL ranged from 0% (food barley, 1 sample) to 100% (oatfeed). There are no maximum levels for this mycotoxin. The highest mean level (406 µg/kg) was found in feed oats, this was higher than the mean level in 2019 (116 µg/kg). The highest maximum level (1368 µg/kg) was found in feed oats, oatfeed had the second highest maximum level (560 µg/kg).
- A small number of samples contained 3-acetyl DON, the maximum level found was 352 µg/kg in food oats. The highest mean level of 58.8 µg/kg was found in oatfeed, this commodity also had the highest incidence (80%) and the second highest maximum level (145 µg/kg). Two samples contained low levels of 15-acetyl DON, these were 20.4 µg/kg in feed wheat and 36.8 µg/kg in feed barley. All mean levels were below the RL. Neosolaniol (NEO) was measured above the RL in food oats (28%), feed oats (40%) and oatfeed (100%), with mean levels of 8.0, 10.7 and 36.8 µg/kg, respectively. A low level of diacetoxyscirpenol (DAS) was found in one sample of feed oats and low levels of fusarenon X (FUS-X) were found in 3 feed oats samples.
- In 2020, T-2 and HT-2 toxins were detected most frequently in oats (food and feed) and oatfeed, 100% oatfeed, 86% food oats and 60% feed oats contained T-2 and HT-2 above the RL. The highest levels were also found in these products. The maximum levels were: 1355 µg/kg in food oats, oatfeed (1956 µg/kg) and 466 µg/kg in feed oats. The mean level found in food oats was 313 µg/kg (compared to 458 µg/kg in 2019) and for feed oats was 183 µg/kg (cf 246 µg/kg in 2019). There are no maximum levels in force for T-2 and HT-2, although limits are being discussed in the EU, the mean values for all products would comply with the levels under discussion. Over the five 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 35% in wheatfeed in this reporting period. Mean levels in these products have generally been below the RL.
- Levels of zearalenone (ZEN) found in 2019 were the lowest of any year of the study, so while levels of incidence and mean levels in 2020 are higher than this they were broadly similar to previous years. The highest level of incidence was found in wheatfeed, oatfeed and feed barley (all 80%), and 50% of feed wheat contained ZEN above the RL. The highest maximum level was 948 µg/kg in a

sample of food oats, although the mean level in food oats was 33.8 µg/kg, so there was not widespread T-2 and HT-2 occurrence in food oats. The highest mean level found was 40.3 µg/kg in oatfeed. The mean levels in the other products ranged from <RL to 33.8 µg/kg.

- Masked forms of deoxynivalenol, T-2 toxin and zearalenone were also analysed. Deoxynivalenol 3-glucoside (DON3G) was found mainly in oatfeed and wheatfeed samples (100% incidence), but there was also a reasonably high incidence in all other products ranging from 34% in food oats to 80% in feed barley. The mean levels were comparable to previous years (except 2019 where they were very low), ranging from 12.1 µg/kg in feed oats to the highest mean level of 118 µg/kg in oatfeed, compared to highest level of 21.9 µg/kg in 2019. T-2 glucoside was detected in food oats (incidence 66%), feed oats (40%) and oatfeed samples (100%), there was also a small incidence in barley samples and feed wheat. The mean level found in oatfeed was 118 µg/kg (compared to 231 µg/kg in 2019). The maximum level found in oatfeed was 205 µg/kg. The highest maximum level found in a food oat sample was 205 µg/kg (compared to 488 µg/kg in 2019), the mean value for food oats was 37 µg/kg compared to 67 µg/kg in 2019. α-ZEL was found in one sample of food oats, and β-ZEL was detected at low levels in small numbers of feed wheat, feed barley, oatfeed and food oats.
- Incidence of ergot alkaloids ranged from 39% in milling wheat to 100% in wheatfeed. The one sample of food barley did not contain ergot alklaoids. The highest maximum level was found in feed wheat (1542 µg/kg), although the mean level was 182 µg/kg. The highest mean level was found in wheatfeed (193 µg/kg), but this was the product with the highest incidence above the RL. The mean levels in all other products were low (from 13.2 to 37.6 µg/kg for sum ergot alkaloids). For food oats the highest maximum level was 242 µg/kg, but the mean level was only slightly higher than 2019 level of 10.1 µg/kg at 18.1µg/kg. Currently, there are no maximum levels for ergot alkaloids, but limits will be introduced within Europe.
- A subset of 25 milling wheat samples were analysed for seven metals; aluminium, arsenic, cadmium, copper, lead, mercury and nickel. Mercury was not detected in any sample. None of the samples exceeded maximum permitted levels for cadmium, arsenic or lead. Data on aluminium, copper and nickel was collected as part of on-going monitoring to understand the background levels of these elements in cereals and levels found were in agreement with previous testing results.

- Stored Samples Mycotoxins - Wheatfeed (90%) and oatfeed (67%) most frequently contained ochratoxin A (OTA). The highest level, 22.5 µg/kg, was found in feed oats. Feed wheat, feed barley and milling wheat had the lowest incidence of OTA, but levels across all products were low. No samples exceeded the ML for ochratoxin A (OTA).
- Matched pairs of malting barley and malt were also analysed for Fusarium mycotoxins. DON and DON3G were found most frequently, 70% of malting barley and 65% of malt contained DON, and 35% of malting barley and 40% of malt contained DON3G. The maximum level was 168 µg/kg DON3G in a malt. The mean levels of DON were 38.6 and 50.6 µg/kg in malting barley and malt, and for DON3G were 9.8 and 31.1 µg/kg in malting barley and malt. Low levels of 15AcDON, nivalenol, T-2 and HT-2 and T2 glucoside were also measured.

- **Pesticides** - One sample of malting barley contained a residue of 2,4-DB at 0.06 mg/kg. The maximum residue level (MRL) is set at 0.05 mg/kg for 2,4-DB in Barley. The residue is above the MRL but it is not an exceedance if measurement uncertainty (±50%) is taken into account.
- 101 samples contained residues of plant growth regulators chlormequat and 39 samples contained mepiquat. None of these residues exceeded their corresponding MRLs.
- A high incidence of residues (83) 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 (91), fungicide tebuconazole (50) and insecticide deltamethrin (61). No MRL is set for piperonyl butoxide.
- Other than the one sample with 2,4-DB residue above, no other samples contained any residue above their corresponding MRLs.
- 124 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”.
- In total 516 residues were detected in the 369 samples tested. Overall, 126 samples (34%) contained no residues and 243 samples (66%) of the samples contained between 1 and 5 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 2020

	No. of Samples Analysed	% > Reporting Limit	Minimum Level µg/kg	Maximum Level µg/kg	2020 Mean Level µg/kg	Median Level µg/kg
Milling Wheat	51	88%	<10	537	57.7	26.6
Feed Wheat	10	90%	<10	1575	293	23.5
Wheatfeed	20	100%	62.3	676	204	180
Feed Barley	10	80%	<10	421	91.7	50.4
Malting Barley	35	69%	<10	176	36.7	18.6
Food Oats	29	45%	<10	1535	97.1	<10
Food Barley	1	100%	105.4	105	105	105
Feed Oats	10	80%	<10	72.6	29.2	24.7
Oatfeed	10	100%	56.8	776	365	418

Table 2. Nivalenol Harvest Results 2020

	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	10%	<50	117	<50	<50
Feed Wheat	10	20%	<50	76.4	13.5	<50
Wheatfeed	20	60%	<50	99.2	43.1	56.0
Feed Barley	10	60%	<50	552	131	62.6
Malting Barley	35	14%	<50	169	17.7	<50
Food Oats	29	62%	<50	363	101	87.9
Food Barley	1	0%	<50	<50	<50	<50
Feed Oats	10	70%	<50	1368	406	218
Oatfeed	10	100%	63.8	560	215	133

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.

Table 3. 3Acetyl-Deoxynivalenol Harvest Results 2020

	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	10	0%	<10	<10	<10	<10
Wheatfeed	20	5%	<10	11.2	0.6	<10
Feed Barley	10	10%	<10	11.2	1.1	<10
Malting Barley	35	0%	<10	<10	<10	<10
Food Oats	29	14%	<10	352	16.4	<10
Food Barley	1	0%	<10	<10	<10	<10
Feed Oats	10	0%	<10	<10	<10	<10
Oatfeed	10	80	<10	145	58.8	73.2

Table 4. 15Acetyl-Deoxynivalenol Harvest Results 2020

	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%	<20	<20	<20	<20
Feed Wheat	10	10%	<20	20.4	2.0	<20
Wheatfeed	20	0%	<20	<20	<20	<20
Feed Barley	10	10%	<20	36.8	3.7	<20
Malting Barley	35	0%	<20	<20	<20	<20
Food Oats	29	0%	<20	<20	<20	<20
Food Barley	1	0%	<20	<20	<20	<20
Feed Oats	10	0%	<20	<20	<20	<20
Oatfeed	10	0%	<20	<20	<20	<20

Table 5. Neosolaniol Harvest Results 2020

	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	10	0%	<10	<10	<10	<10
Wheatfeed	20	0%	<10	<10	<10	<10
Feed Barley	10	0%	<10	<10	<10	<10
Malting Barley	35	3%	<10	30.9	0.9	<10
Food Oats	29	28%	<10	65.7	8.0	<10
Food Barley	1	0%	<10	<10	<10	<10
Feed Oats	10	40%	<10	48.7	10.7	<10
Oatfeed	10	100%	16.9	55.8	36.8	37.5

Table 6. HT-2 + T-2 Harvest Results 2020

	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	50.2	<20	<20
Feed Wheat	10	0%	<20	<20	<20	<20
Wheatfeed	20	35%	<20	58.5	10.5	<20
Feed Barley	10	10%	<20	21.0	2.1	<20
Malting Barley	35	6%	<20	190	6.0	<20
Food Oats	29	86%	<20	1355	313	106
Food Barley	1	0%	<20	<20	<20	<20
Feed Oats	10	60%	<20	466	183	124
Oatfeed	10	100%	350	1956	1132	1092

Table 7. Zearalenone Harvest Results 2020

	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	16%	<2.5	37.2	<2.5	<2.5
Feed Wheat	10	50%	<2.5	191	29.0	1.9
Wheatfeed	20	80%	<2.5	178	23.5	10.9
Feed Barley	10	80%	<2.5	114	25.8	9.9
Malting Barley	35	31%	<2.5	28.1	3.1	<2.5
Food Oats	29	24%	<2.5	948	33.8	<2.5
Food Barley	1	0%	<2.5	<2.5	<2.5	<2.5
Feed Oats	10	30%	<2.5	4.0	1.0	<2.5
Oatfeed	10	80%	<2.5	102	40.3	41.0

Table 8. Deoxynivalenol-3-Glucoside Harvest Results 2020

	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	57%	<10	84.3	13.3	12.4
Feed Wheat	10	50%	<10	174	36.4	5.3
Wheatfeed	20	100%	14.8	106	29.6	25.7
Feed Barley	10	80%	<10	324	64.7	47.6
Malting Barley	35	46%	<10	70.7	14.6	<10
Food Oats	29	34%	<10	537	33.1	<10
Food Barley	1	100%	42.5	42.5	42.5	42.5
Feed Oats	10	80%	<10	23.3	12.1	12.6
Oatfeed	10	100%	20.8	235	118	105

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Table 9. T-2-b3-Glucoside Harvest Results 2020

	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	10	10%	<10	10.1	1.0	<10
Wheatfeed	20	0%	<10	<10	<10	<10
Feed Barley	10	30%	<10	10.8	3.1	<10
Malting Barley	35	3%	<10	56.1	1.6	<10
Food Oats	29	66%	<10	205	37.1	18.6
Food Barley	1	0%	<10	<10	<10	<10
Feed Oats	10	40%	<10	239	61.5	<10
Oatfeed	10	100%	29.8	205	118	105

Table 10. Total Ergot Alkaloids (n=12) Harvest Results 2020

	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	39%	<6.0	468	31.1	<6.0
Feed Wheat	10	90%	<6.0	1542	182	31.1
Wheatfeed	20	100%	54.2	420	193	162
Feed Barley	10	70%	<6.0	213	37.6	4.6
Malting Barley	35	54%	<6.0	251	13.5	0.7
Food Oats	29	48%	<6.0	242	18.1	<6.0
Food Barley	1	0%	<6.0	<6.0	<6.0	<6.0
Feed Oats	10	60%	<6.0	258	37.0	7.4
Oatfeed	10	80%	<6.0	43.0	13.2	4.6

** 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, 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 2020

	No. of Samples Analysed	% > Reporting Limit	Minimum Level µg/kg	Maximum Level µg/kg	Mean Level µg/kg	Median Level µg/kg
Aluminium	25	96	0.5	101	10.8	4.7
Nickel	25	100	0.09	1.21	0.31	0.17
Copper	25	100	2.5	4.4	3.41	3.2
Arsenic	25	16	<0.01	0.04	0.01	<0.01
Cadmium	25	100	0.01	0.14	0.05	0.04
Mercury	25	0	<0.01	<0.01	<0.01	<0.01
Lead	25	32	<0.01	0.05	0.01	<0.01

Table 12. Ochratoxin A Stored Sample Results 2020-2021

	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	2.3	<0.2	<0.2
Malt	20	25%	<0.2	2.6	0.2	<0.2

Table 13. Ochratoxin A Stored Sample 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 (January)	26	12%	<0.2	3.5	0.2	<0.2
Milling Wheat (March)	25	12%	<0.2	7.4	0.32	<0.2
Feed Wheat	40	13%	<0.2	4.8	<0.2	<0.2
Wheat Feed	9	67%	<0.2	2.1	0.6	0.5
Feed Barley	28	18%	<0.2	17.2	1.2	<0.2
Food Oats	30	13%	<0.2	4	0.2	<0.2
Feed Oats	8	13%	<0.2	12.4	1.6	<0.2
Oatfeed	9	100%	0.5	4.2	1.8	1.1

Table 14. Field Mycotoxins Malting Barley & Malt Results 2020-2021

	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	70%	<10	184	38.6	17.1
Malt	20	65%	<10	237	50.6	16.5
Deoxynivalenol-3-Glucoside						
Malting Barley	20	35%	<10	59.0	9.8	<10
Malt	20	40%	<10	168	31.1	<10
3-Acetyl Deoxynivalenol						
Malting Barley	20	0%	<10	<10	<10	<10
Malt	20	5%	<10	14.0	0.7	<10
15-Acetyl Deoxynivalenol						
Malting Barley	20	10%	<20	27.9	2.6	<20
Malt	20	20%	<20	40.6	6.8	<20
T-2-b3-Glucoside						
Malting Barley	20	5%	<10	10.7	0.5	<10
Malt	20	0%	<10	<10	<10	<10
HT-2 +T2						
Malting Barley	20	20%	<20	45.1	5.3	<20
Malt	20	0%	<20	<20	<20	<20
NIV						
Malting Barley	20	10%	<50	93.6	9.2	<50
Malt	20	0%	<50	<50	<50	<50

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

Table 15. Pesticides Harvest Results 2020

	No. of Samples Analysed	% > LOD	Single Pesticide Incidence % > LOD	Multiple Pesticide Incidence % > LOD
Milling Wheat [1]	51	100%	22%	78%
Malting Barley [2]	43	19%	14%	5%
Food Oats [3]	29	90%	24%	66%
Barley [4]	1	100%	0%	100%
Feed Wheat [5]	11	82%	82%	
Feed Barley [6]	9	89%	89%	
Feed Oats [7]	10	50%	50%	

[1] azoxystrobin (2) 0.011, 0.016 mg/kg; bixafen (1) 0.023 mg/kg; boscalid (2) 0.012 mg/kg; chlormequat (46) 0.036-1.1 mg/kg; fluoxastrobin (2) 0.020, 0.022 mg/kg; glyphosate (19) 0.14-1.2 mg/kg; mepiquat (7) 0.013-0.36 mg/kg; prothioconazole (2) 0.026, 0.031 mg/kg; tebuconazole (31) 0.010-0.057 mg/kg.

[2] azoxystrobin (1) 0.032 mg/kg; boscalid (1) 0.076 mg/kg; cyproconazole (2) 0.015 mg/kg; cyprodinil (3) 0.011-0.078; fluxapyroxad (2) 0.014, 0.020 mg/kg; tebuconazole (1) 0.018 mg/kg.

[3] azoxystrobin (2) 0.010, 0.019 mg/kg; chlormequat (21) 0.017-5.3 mg/kg; cyproconazole (2) 0.016, 0.020 mg/kg; epoxiconazole (3) 0.014-0.029 mg/kg; glyphosate (16) 0.19-4.2 mg/kg; mepiquat (6) 0.039-0.35 mg/kg; tebuconazole (5) 0.018-0.046 mg/kg.

[4] bixafen (1) 0.012 mg/kg; glyphosate (1) 0.74 mg/kg.

[5] Glyphosate (9) 0.14-1.2 mg/kg (not tested for other pesticides).

[6] Glyphosate (8) 0.15-1.8 mg/kg (not tested for other pesticides).

[7] Glyphosate (5) 0.92-6.0 mg/kg (not tested for other pesticides).

Table 16. Pesticides Harvest Additional Compounds 2020

	No. of Samples Analysed	% > LOD	Single Pesticide Incidence % > LOD	Multiple Pesticide Incidence % > LOD
Milling Wheat [1]	51	18%	12%	6%
Malting Barley [2]	43	35%	19%	16%
Food Oats [3]	29	17%	3%	14%
Barley [4]	1	100%	0%	100%
Feed Wheat [5]				
Feed Barley [6]				
Feed Oats [7]				

[1] deltamethrin (2) 0.087, 0.094 mg/kg; piperonyl butoxide (7) 0.020-0.94 mg/kg; flonicamid metabolite (TFNA) (1) 0.010mg/kg; flonicamid metabolite (TFNG) (2) 0.013, 0.12 mg/kg.

[2] **2,4-DB (1) 0.060 mg/kg (MRL set at 0.05 mg/kg)**; deltamethrin (7) 0.013-0.19 mg/kg; fluroxypyr (3) 0.014-0.050 mg/kg; isopyrazam (1) 0.014; piperonyl butoxide (12) 0.010-2.5mg/kg.

[3] deltamethrin (4) 0.031-0.32 mg/kg; piperonyl butoxide (5) 0.035-2.5 mg/kg.

[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 17. Pesticides Malting Barley & Malt Stored Sample Results 2020-2021

	No. of Samples Analysed	% > LOD	Single Pesticide Incidence % > LOD	Multiple Pesticide Incidence % > LOD
Malting Barley [1]	20	100%	95%	5%
Malt [2]	20	100%	90%	10%

[1] chlorate (1) 0.024mg/kg; chlormequat (18) 0.019-0.57mg/kg; deltamethrin (8) 0.019-0.23mg/kg; glyphosate (10) 0.10-1.0mg/kg; mepiquat (13) 0.020-0.75mg/kg.

[2] chlormequat (16) 0.026-1.1mg/kg; deltamethrin (9) 0.011-0.25mg/kg; glyphosate (15) 0.13-2.2mg/kg; mepiquat (13) 0.010-0.59mg/kg.

Table 18. Pesticides Malting Barley & Malt Additional Compounds Results 2020-2021

	No. of Samples Analysed	% > LOD	Single Pesticide Incidence % > LOD	Multiple Pesticide Incidence % > LOD
Malting Barley [1]	20	40%	40%	0%
Malt [2]	20	40%	45%	0%

[1] piperonyl butoxide (8) 0.028-1.2mg/kg.

[2] piperonyl butoxide (9) 0.045-2.4mg/kg.

Table 19. Chlorpropham Stored Sample Results 2021

	No. of Samples Analysed	% > LOD	Single Pesticide Incidence % > LOD	Multiple Pesticide Incidence % > LOD
Milling Wheat	26	0%	0%	0%

Table . Pesticides Stored Additional Compounds 2021

	No. of Samples Analysed	% > Reporting Limit	Single Pesticide Incidence % > LOD	Multiple Pesticide Incidence % > LOD
Milling Wheat	26	23%	15%	8%

cypermethrin (2) 0.090, 0.18 mg/kg; deltamethrin (5) 0.018 – 0.087 mg/kg; permethrin (1) 0.049 mg/kg.

Table 21. Pesticides Stored Sample Results 2021

	No. of Samples Analysed	% > LOD	Single Pesticide Incidence % > LOD	Multiple Pesticide Incidence % > LOD
Food Oats [1]	30	0%	0%	0%
Milling Wheat [2]	24	25%	21%	4%
Spelt [3]	1	0%	0%	0%
Feed Wheat [4]	40	18%	18%	0%
Wheatfeed [5]	9	89%	44.5%	44.5%
Feed Barley [6]	28	25%	21%	4%
Feed Oats [7]	8	0%	0%	0%
Oatfeed [8]	9	67%	22%	44%

[2] cypermethrins (1) 0.045mg/kg; deltamethrin (4) 0.042-0.31mg/kg; pirimiphos-methyl (2) 0.032-0.31mg/kg.

[4] cypermethrins (1) 0.026mg/kg; deltamethrin (6) 0.011-0.12mg/kg.

[5] cypermethrins (3) 0.025-0.071mg/kg; deltamethrin (5) 0.011-0.11mg/kg; pirimiphos-methyl (5) 0.014-8.7mg/kg.

[6] chlorpropham (1) 0.056mg/kg; chlorpyrifos-methyl (1) 0.021mg/kg; deltamethrin (6) 0.015-0.095mg/kg.

[8] deltamethrin (5) 0.019-0.071mg/kg; pirimiphos-methyl (5) 0.010-0.036mg/kg.

No MRLs are set for feed or crops meant for animal feed in UK or EU

Table 22. Pesticides Stored Additional Compounds 2021

	No. of Samples Analysed	% > LOD	Single Pesticide Incidence % > LOD	Multiple Pesticide Incidence % > LOD
Food Oats [1]	30	47%	40%	7%
Milling Wheat [2]	24	46%	33%	13%
Spelt [3]	1	0%	0%	0%
Feed Wheat [4]	40	35%	30%	5%
Wheatfeed [5]	9	89%	78%	11%
Feed Barley [6]	28	57%	53.5%	3.5%
Feed Oats [7]	8	63%	50%	13%
Oatfeed [8]	9	78%	22%	56%

[1] azoxystrobin (2) 0.014, 0.018mg/kg; BAC 12 (1) 0.083mg/kg; bixafen (1) 0.026mg/kg; epoxiconazole (5) 0.017-0.032mg/kg; fluroxypyr (1) 0.015mg/kg; fluxapyroxad (1) 0.013mg/kg; piperonyl butoxide (2) 0.015, 0.017mg/kg; pyraclostrobin (2) 0.011, 0.013mg/kg; tebuconazole (1) 0.012mg/kg;

[2] azoxystrobin (1) 0.029mg/kg; boscalid (1) 0.011mg/kg; MCPA (1) 0.17mg/kg; piperonyl butoxide (7) 0.010-2.8mg/kg; tebuconazole (4) 0.010-0.014mg/kg; TFNG (1) 0.012 mg/kg; flonicamid sum (1) 0.011mg/kg sum of flonicamid,TFNA and TFNG expressed as flonicamid.

[4] azoxystrobin (1) 0.011mg/kg; fluopyram (1) 0.013mg/kg; piperonyl butoxide (9) 0.013-0.81mg/kg; tebuconazole (6) 0.010-0.024mg/kg.

[5] piperonyl butoxide (8) 0.029-0.95mg/kg; tebuconazole (1) 0.018mg/kg.

[6] bixafen (1) 0.057mg/kg; boscalid (1) 0.031mg/kg; fluroxypyr (1) 0.014mg/kg; fluxapyroxad (2) 0.013, 0.013mg/kg; piperonyl butoxide (12) 0.011-0.75mg/kg.

[7] azoxystrobin (1) 0.012mg/kg; piperonyl butoxide (5) 0.012-0.068mg/kg; tebuconazole (1) 0.029mg/kg.

[8] azoxystrobin (5) 0.011-0.016mg/kg; piperonyl butoxide (7) 0.022-0.17mg/kg; pyraclostrobin (2) 0.012, 0.016mg/kg.

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Figure 1. Incidence of Pesticides