

UFAS Review of Mycotoxins in Feed 2024

Each year, a cohort of UK UFAS compound feed Participants on a three-yearly rotation, are selected to submit feed samples for analysis of the following mycotoxins.

- Aflatoxin B1
- Deoxynivalenol (DON)
- Zearalenone (ZON)
- Ochratoxin A (OTA)
- Fumonisin B1 and B2 (from 2023 onwards)
- T-2 and HT-2

By analysing a broad range of mycotoxins, the level of compliance with legal and guidance limits within the UK feed supply chain is monitored. In the 2024 round of testing (1 March 2024- 28 February 2025) 51 feed samples were submitted in total. The results from this screening were evaluated alongside those obtained from feeds analysed between 2017 and 2023. It must be noted that only five feeds were sampled in 2020 due to COVID.

The yearly results presented in the report are split to allow comparison with current legal or guidance levels for each animal category. The analytical method was moved from high-performance liquid chromatography (HPLC) to Liquid chromatography–mass spectrometry (LC-MS) in the 2024 season, which increased the limit of detection value (LOD) compared with previous years. The LC-MS method LOD, however, remains significantly below the lower ranges of species category limits and does not affect interpretation of the overall results. The data are presented in the tables and associated graphs, including sample numbers and annual averages in the appendices.

Aflatoxin B1

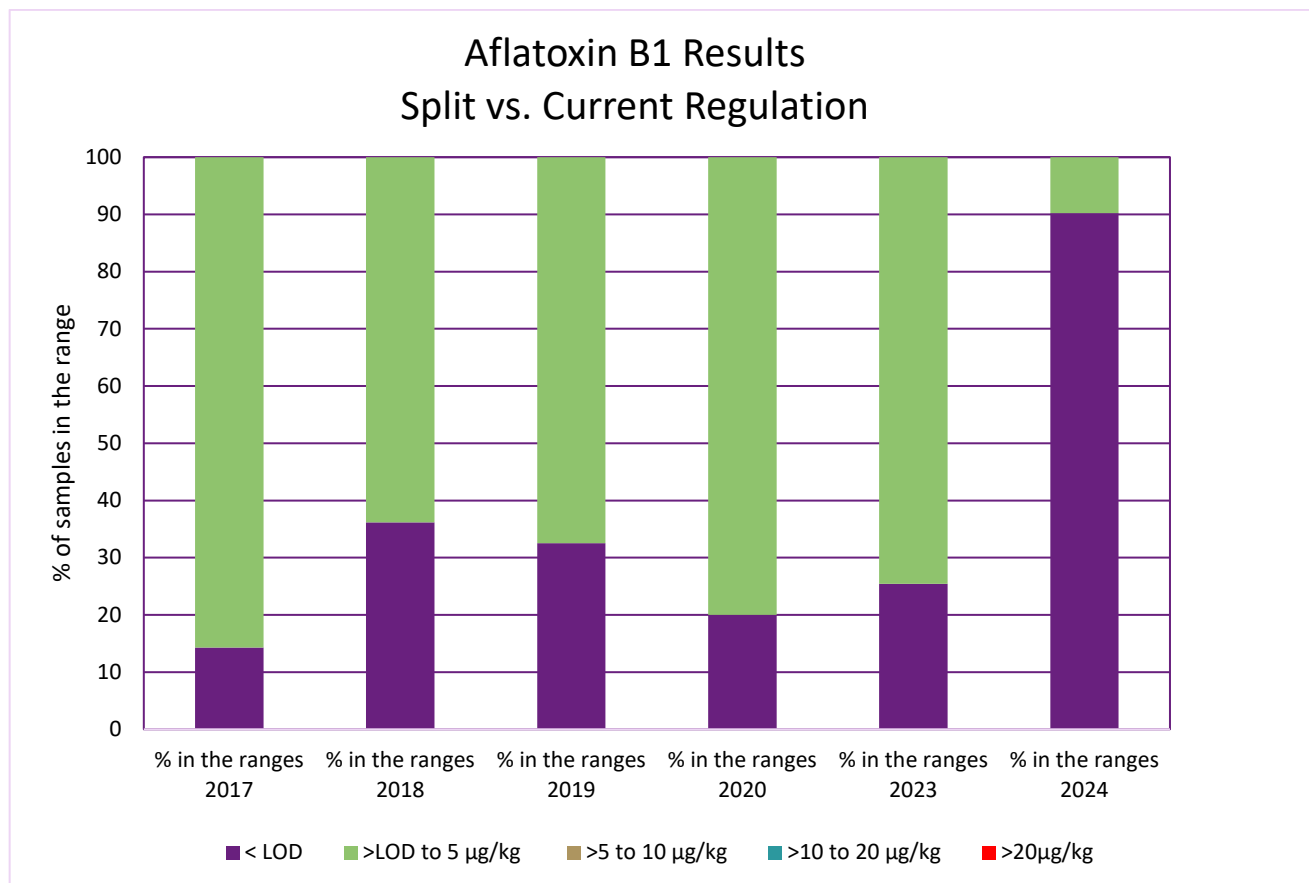
Current legal limits for Aflatoxin B1 in animal feeds are presented in Table 1. The laboratory results summary is presented in Figure 1 and Appendix 1.

Table 1: Legal Maximum Limits for Aflatoxin B1 ($\mu\text{g}/\text{kg}$, feed moisture 12%)

Level $\mu\text{g}/\text{kg}$	Limit
<0.2	Limit of detection for analysis – not detected
5	Limit for compound feed for dairy cattle and calves, dairy sheep and lambs, dairy goats and kids, piglets and young poultry animals,
10	Limit for other complementary and complete feed
20	Limit for compound feed for cattle (except dairy cattle and calves), sheep (except dairy sheep and lambs), goats (except dairy goats and kids), pigs (except piglets) and poultry (except young animals).

Between 2017 and 2024, the level of Aflatoxin B1 in animal feed consistently remained below the threshold of $5 \mu\text{g}/\text{kg}$. The highest recorded level during this period was $2.02 \mu\text{g}/\text{kg}$ in a 2018 sample. It is noted that the specific feed type was not identified. In 2024, the highest level detected was $0.81 \mu\text{g}/\text{kg}$, which is lower than the 2023 peak of $1.88 \mu\text{g}/\text{kg}$. This 2024 result is well below the maximum limit of $5 \mu\text{g}/\text{kg}$ set for compound feed intended for dairy cattle and calves, dairy sheep and lambs, dairy goats and kids, piglets, and young poultry. Overall, the data indicate a low risk of Aflatoxin B1 contamination within the UK feed supply chain.

Figure 1: Yearly Aflatoxin Results Summary (split by legal limit)



Deoxynivalenol (DON)

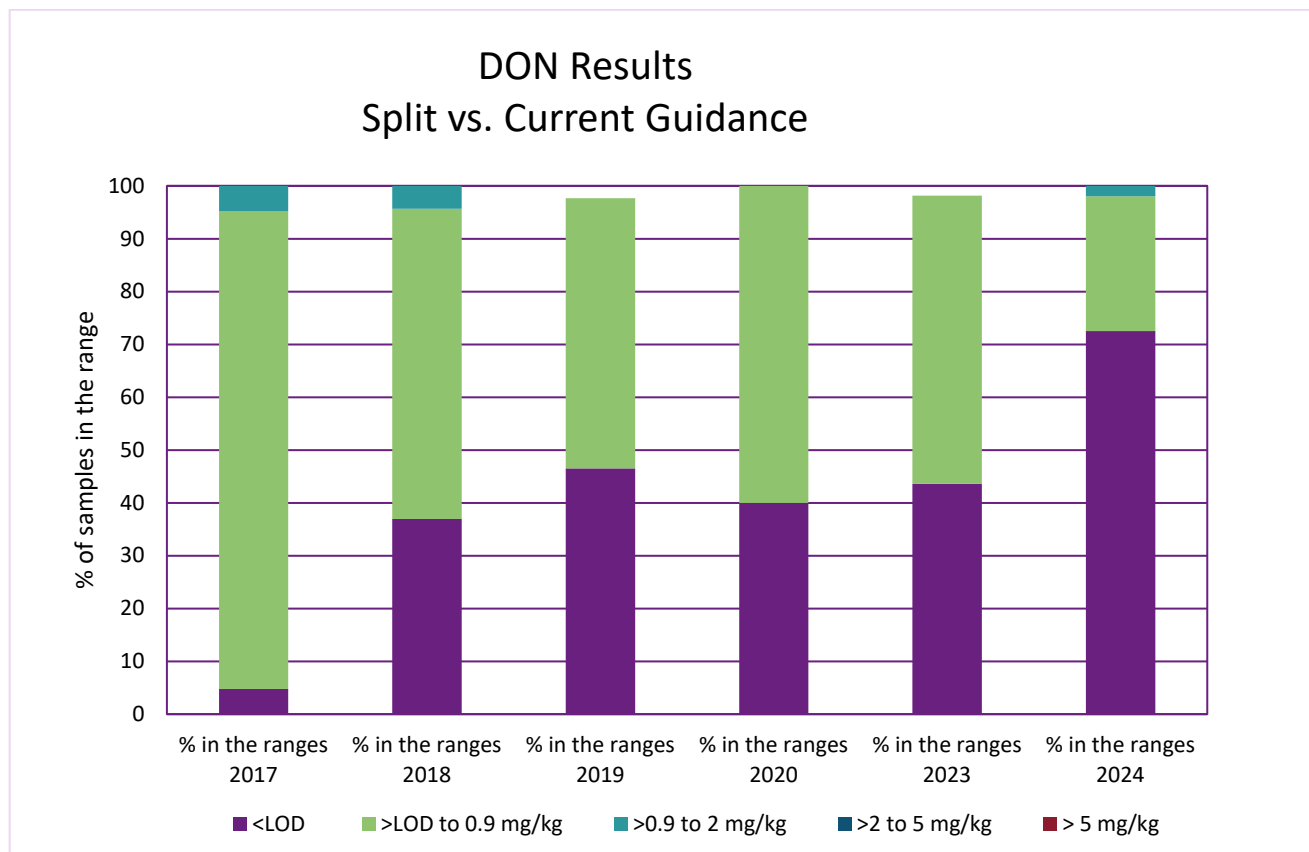
The current guidelines for maximum levels of DON in animal feeds are detailed in Table 2. The laboratory results summary is presented in Figure 2 and Appendix 2.

Table 2: Maximum Guidelines for DON in Animal Feeds (mg/kg)

Level mg/kg	Limit
< 0.05	Limit of detection for analysis – not detected
0.9	Guidance level for compound feed for pigs
2	Guidance level for compound feed for young animals, except piglets
5	Guidance level for other compound feeds

The 2024 feed samples were below 0.9 mg/kg, except for a beef grower feed which was found to contain 1.14 mg/kg DON. This result is above the feed guidance limit for pigs but within the guidance limits for the species it was intended. Overall, the results indicate that the current risk of DON in UK feed is currently low.

Figure 2: Yearly DON Results Summary (split by guidance limit)



Zearalenone (ZON)

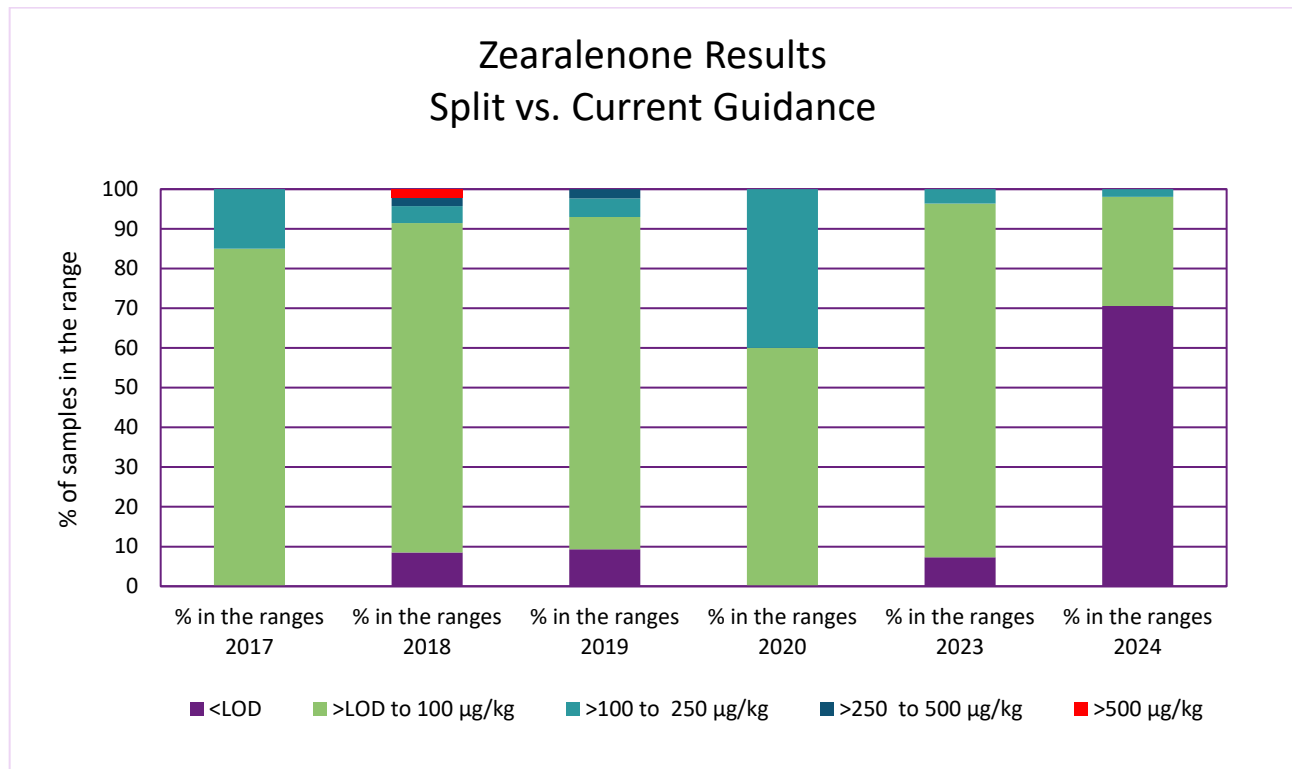
The current guidelines for maximum levels of ZON in animal feeds are detailed in Table 3. The laboratory results summary is presented in Figure 3 and Appendix 3.

Table 3: Maximum Guidelines for ZON in Animal Feeds ($\mu\text{g}/\text{kg}$)

Level $\mu\text{g}/\text{kg}$	Limit
< 10	Limit of detection
100	Guidance level compound feed for piglets, gilts
250	Guidance level compound feed for sows and fattening pigs
500	Guidance level compound feed for calves, dairy cattle, sheep (including lamb) and goats (including kids)

In the 2024 sampling year, none of the submitted feed samples exceeded the highest guidance limit of 500 $\mu\text{g}/\text{kg}$ for compound feed. The highest level detected was 107 $\mu\text{g}/\text{kg}$ in a sample described as soya hulls. Although this slightly exceeds the 100 $\mu\text{g}/\text{kg}$ limit for piglets and gilts, soya hulls are however considered a straight feed material, typically used in compound or blended feeds. In previous years, Zearalenone (ZON) levels were also within acceptable limits, with one notable exception in 2018. A sample labelled as "feed/grain" contained 1,471 $\mu\text{g}/\text{kg}$ of ZON—well above the compound feed limit of 500 $\mu\text{g}/\text{kg}$. Assuming, however, that this was a straight cereal product, it would fall within the regulatory limit of 2,000 $\mu\text{g}/\text{kg}$ for cereals and cereal products (excluding maize). Overall, the review of these results indicated a low risk of ZON contamination in feeds.

Figure 3: Yearly ZON Results Summary (split by guidance limit)



Ochratoxin A

The current guidelines for maximum levels of OTA in animal feeds are detailed in Table 4. The laboratory results summary is presented in Figure 4 and Appendix 4.

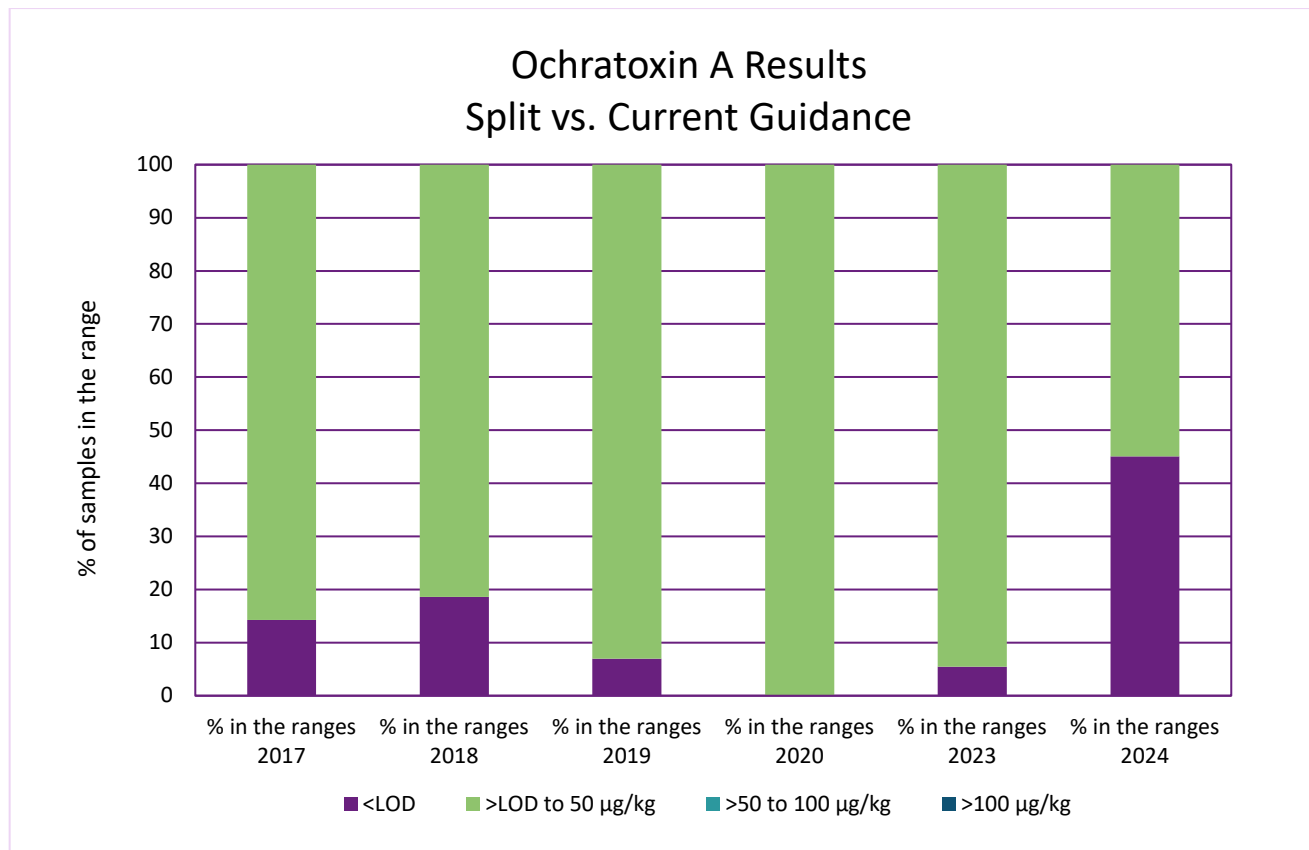
Table 4: Maximum Guidelines for OTA in Animal Feeds (µg/kg).

Level µg/kg	Limit
<0.4	Limit of detection for analysis – not detected
50	Guidance level compound feed for pigs
100	Guidance level compound feed for poultry

All OTA levels in the feeds analysed in all years were below 50 µg/kg, the guidance level of compound feed for pigs. The risk of OTA in UK feed would currently appear to be low. The highest recovery in the 2024

sampling cohort was 6.49 $\mu\text{g}/\text{kg}$ in cattle feed. It should be noted that no guidance limit is published for ruminants.

Figure 4: Yearly OTA Results Summary (split by guidance limit)



Fumonisin B1 and B2

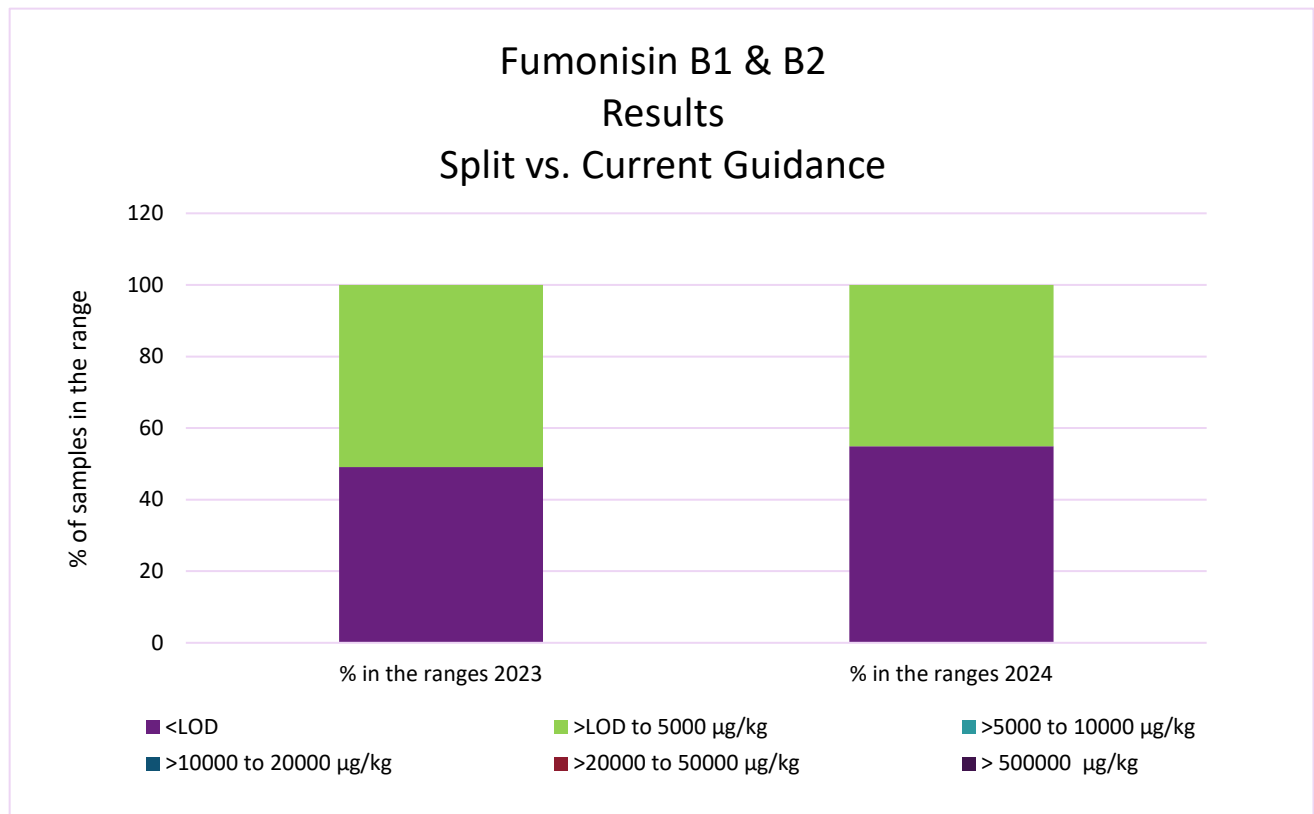
Fumonisin B1 and B2 monitoring commenced in 2023. The current guidelines for maximum levels of Fumonisin B1 and B2 in animal feeds are detailed in Table 5. The laboratory results summary is presented in Figure 5 and Appendix 5.

Table 5: Maximum Guidelines for Fumonisin B1 and B2 in Animal Feeds ($\mu\text{g/kg}$)

Level $\mu\text{g/kg}$	Limit
>20	Limit of detection for analysis – not detected – total amount B1 and B2
5000	Guidance level compound feed pigs, horses (Equidae), rabbits and pet animals
10000	Guidance level compound feed fish
20000	Guidance level compound feed for poultry, calves (< 4 months), lambs and kids
50000	Guidance level compound feed for adult ruminants (> 4 months)

In 2024, the highest recovery of B1 and B2 in the feeds evaluated was 376.3 $\mu\text{g/kg}$ in a sample of calf rearing nuts. The highest level detected of 1972 $\mu\text{g/kg}$ was detected in a 2023 ruminant blend, this amount is 9.8% if the limit for feed intended for poultry, calves (< 4 months), lambs and kids. Overall, the data from 2023 and 2024 establishes that the risk exceeding the maximum guidelines of mycotoxins B1 and B2 in feeds is low.

Figure 5: Fumonisin B1 and B2 2023 Results Summary (split by guidance limit)



T-2 and HT-2

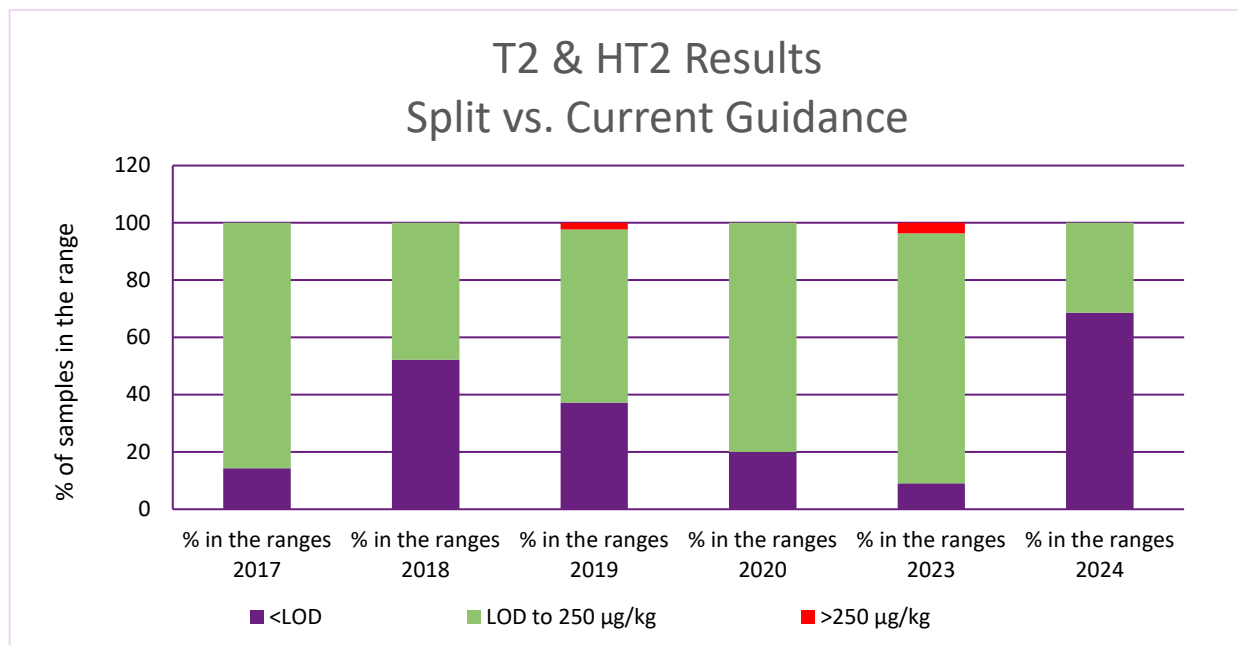
The current guidelines for maximum levels of T-2 and HT-2 in animal feeds are detailed in Table 6. The laboratory results summary is presented in Figure 6 and Appendix 6.

Table 6: Maximum Guidelines for T-2 and HT-2 in Animal Feeds ($\mu\text{g}/\text{kg}$)

Level $\mu\text{g}/\text{kg}$	Limit
<3	Not Detected/LOD
250	Guidance level for compound feeds

During the 2024 testing period, none of the submitted feed samples exceeded the guidance level of 250 $\mu\text{g}/\text{kg}$ for compound feeds. The highest concentration detected was 241 $\mu\text{g}/\text{kg}$ in a horse feed sample, representing 96% of the maximum threshold. Historically, there have been occasional exceedances. In 2019, a sample generically identified as "feed" contained 1,147.8 $\mu\text{g}/\text{kg}$, which is significantly above the guidance level. Similarly, in 2023, a dairy compound feed sample was found to contain 355.97 $\mu\text{g}/\text{kg}$, and a sample of calf and beef nuts measured 250.96 $\mu\text{g}/\text{kg}$. These occasional spikes and high results highlight the importance of continued vigilance and routine monitoring by the industry. Focus on potential sources is essential as certain feed types, particularly oat-based products, are known to carry a higher risk of this mycotoxin type.

Figure 6: T-2 and HT-2 Results Summary (split by guidance limit)



Conclusion

The 2024 feed sample testing period results submitted by UFAS Participants show that the overall risk of mycotoxins in UK animal feed remains low. Environmental factors such as shifting weather patterns and inconsistent harvesting conditions can, however, affect mycotoxin development in crops and, by extension, in animal feeds. Given the occasional spikes of key mycotoxins observed in previous years, it is essential that feed manufacturers continue to conduct proactive risk assessments. Regular monitoring of both raw materials and finished feeds should remain a priority to minimise and manage the risk of exceeding species-specific legal and guidance limits.

For more information, please contact

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Appendix 1: Aflatoxin B1 Results Segmented by Guidance Limit

Aflatoxin						Total Number of Feed Samples	Maximum Amount Recovered $\mu\text{g/kg}$
	< LOD	5 $\mu\text{g/kg}$ Max. Compound feed for dairy cattle and calves, dairy sheep and lambs, dairy goats and kids, piglets and young poultry animals	10 $\mu\text{g/kg}$ Max. Other complementary and complete feed	20 $\mu\text{g/kg}$ Max. Compound feed for cattle (except dairy cattle and calves), sheep (except dairy sheep and lambs), goats (except dairy goats and kids), pigs (except piglets) and poultry (except young animals)			
		>LOD to 5 $\mu\text{g/kg}$	>5 to 10 $\mu\text{g/kg}$	>10 to 20 $\mu\text{g/kg}$	>20 $\mu\text{g/kg}$		
Numbers 2017	3	18	0	0	0	21	0.4
% in the ranges 2017	14	86	0	0	0		
Numbers 2018	17	30	0	0	0	47	0.4
% in the ranges 2018	36	64	0	0	0		
Numbers 2019	14	29	0	0	0	43	2.02
% in the ranges 2019	33	67	0	0	0		
Numbers 2020	1	4	0	0	0	5	1.29
% in the ranges 2020	20	80	0	0	0		
Numbers 2023	14	41	0	0	0	55	1.88
% in the ranges 2023	25	75	0	0	0		
Numbers 2024	46	5	0	0	0	51	0.81
% in the ranges 2024	90	10	0	0	0		
						222	

	Mean $\mu\text{g/kg}$	Standard Dev. of the Sample
2017	0.072	0.092
2018	0.069	0.091
2019	0.118	0.307
2020	0.300	0.092
2023	0.083	0.252
2024	0.195	0.101

Appendix 2: DON Results Segmented by Guidance Limit

DON		0.9 mg/kg Max. compound feed for pigs	2 mg/kg Max. Compound feed for young animals, except piglets	5 mg/kg Max. Other compound feeds			
	<LOD	>LOD to 0.9 mg/kg	>0.9 to 2 mg/kg	>2 to 5 mg/kg	> 5 mg/kg	Total Number of Feed Samples	Maximum Amount Recovered mg/kg
Numbers 2017	1	19	1	0	0	21	1.13
% in the ranges 2017	5	90	5	0	0		
Numbers 2018	17	27	0	2	0	46	4.39
% in the ranges 2018	37	59	4	0	0		
Numbers 2019	20	22	0	0	43	43	1.27
% in the ranges 2019	47	51	0	0	0		
Numbers 2020	2	3	0	0	0	5	0.15
% in the ranges 2020	40	60	0	0	0		
Numbers 2023	24	30	1	0	0	55	0.928
% in the ranges 2023	44	55	0	0	0		
Numbers 2024	37	13	1	0	0	51	1.14
% in the ranges 2024	73	25	2	0	0		
						221	

	Mean mg/kg	Standard Dev. of the Sample
2017	0.28	0.25
2018	0.34	0.81
2019	0.22	0.25
2020	0.11	0.05
2023	0.17	0.17
2024	0.11	0.18

Appendix 3: ZON Results Segmented by Guidance Limit

ZON

		100 µg/kg Max. Compound feed for piglets, gilts	250 µg/kg Max. Compound feed for sows and fattening pigs	500 µg/kg Max. compound feed for calves, dairy cattle, sheep (including lamb) and goats (including kids)			
	<LOD	>LOD to 100 µg/kg	>100 to 250 µg/kg	>250 to 500 µg/kg	>500 µg/kg	Total Number of Feed Samples	Maximum Amount Recovered µg/kg
Numbers 2017	0	17	3	0	0	20	185
% in the ranges 2017	0	85	15	0	0		
Numbers 2018	4	39	2	1	1	47	1471
% in the ranges 2018	9	83	4	2	2		
Numbers 2019	4	36	2	1	0	43	319
% in the ranges 2019	9	84	5	2	0		
Numbers 2020	0	3	2	0	0	5	22
% in the ranges 2020	0	60	40	0	0		
Numbers 2023	4	49	2	0	0	55	147
% in the ranges 2023	7	89	4	0	0		
Numbers 2024	36	14	1	0	0	51	107
% in the ranges 2024	71	27	2	0	0		
						221	

	Mean µg/kg	Standard Dev. of the Sample
2017	42.05	45.93
2018	69.30	221.46
2019	42.38	56.69
2020	14.00	6.32
2023	18.88	28.46
2024	15.69	19.17

Appendix 4: OTA Results Segmented by Guidance Limit

OTA					Total Number of Feed Samples	Maximum Amount Recovered µg/kg
	<LOD	50 µg/kg Max. Compound feed for pigs >LOD to 50 µg/kg	100 µg/kg Max. Compound Feed for poultry >50 to 100 µg/kg	>100 µg/kg		
Numbers 2017	3	18	0	0	21	24.3
% in the ranges 2017	14	86	0	0		
Numbers 2018	8	35	0	0	43	2.4
% in the ranges 2018	19	81	0	0		
Numbers 2019	3	40	0	0	43	18.3
% in the ranges 2019	7	93	0	0		
Numbers 2020	0	5	0	0	5	4.5
% in the ranges 2020	0	100	0	0		
Numbers 2023	3	52	0	0	55	3.93
% in the ranges 2023	5	95	0	0		
Numbers 2024	23	28	0	0	51	6.49
% in the ranges 2024	45	55	0	0		
					218	

	Mean µg/kg	Standard Dev. of the Sample
2017	2.02	5.31
2018	0.50	0.53
2019	1.41	3.15
2020	1.56	1.74
2023	0.54	0.71
2024	1.00	1.26

Appendix 5: Fumonisin B1 and B2 Results Segmented by Guidance Limit

B1 & B2

	<u>Not Detected</u>	500 µg/kg Max. Compound feed pigs, horses (Equidae), rabbits and pet animals	10000 µg/kg Max Compound feed fish	20000 µg/kg Max. Compound feed for poultry, calves (< 4 months), lambs and kids	50000 Max µg/kg Compound feed for adult ruminants (> 4 months)		Total Number of Feed Samples	Maximum Amount Recovered µg/kg
	<LOD	>LOD to 5000 µg/kg	>5000 to 10000 µg/kg	>10000 to 20000 µg/kg	>20000 to 50000 µg/kg	> 500000 µg/kg		
Numbers 2023	27	28	0	0	0	0	55	1972
% in the ranges 2023	49	51	0	0	0	0		
Numbers 2024	28	23	0	0	0	0	51	376.3
% in the ranges 2024	55	45	0	0	0	0		

	Mean µg/kg	STDEV
2017	-	
2018	-	
2019	-	
2020	-	
2023	117.31	310.39
2024	42.60	57.85

Appendix 6: T-2 and HT-2 Results Segmented by Guidance Limit

T2 & HT-2		250 µg/kg Max. Compound Feeds		Total Number of Feed Samples	Maximum Amount Recovered µg/kg
	<LOD	LOD to 250 µg/kg	>250 µg/kg		
Numbers 2017	3	18	0	21	39
% in the ranges 2017	14	86	0		
% in the ranges 2018	24	22	0	46	236.8
% in the ranges 2018	52	48	0		
Numbers 2019	16	26	1	43	1147.8
% in the ranges 2019	37	60	2		
Numbers 2020	1	4	0	5	37.9
% in the ranges 2020	20	80	0		
Numbers 2023	5	48	2	55	355.97
% in the ranges 2023	9	87	4		
Numbers 2024	35	16	0	51	241
% in the ranges 2024	69	31	0		
					221

	Mean µg/kg	Standard Dev. of the Sample
2017	20.31	20.82
2018	19.74	39.02
2019	46.18	173.69
2020	26.88	12.88
2023	35.13	57.48
2024	47.43	50.07