

# Evaluation of Analytical Results for Mycotoxins in Corn and Corn DDGs

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# Mycotoxin Analysis



## ELISA

Quantification of specific mycotoxins in given matrices

- + Fast
- + Inexpensive
- Only for raw materials
- High LOD



## Lateral Flow

Quantification of specific mycotoxins in given matrices

- + Fast
- + Inexpensive
- Not available for all MTX



## HPLC

Quantification of single toxins at low concentrations

- + Fullfills legal requisites
- Time consuming
- Expensive



## LC-MS/MS

Simultaneous detection of multiple toxins in a wide variety of food and agricultural commodities

- + Sensitive
- + Suitable for various matrices
- + Detection of masked MTX
- Highly qualified operator
- Expensive

# Mycotoxin Analysis



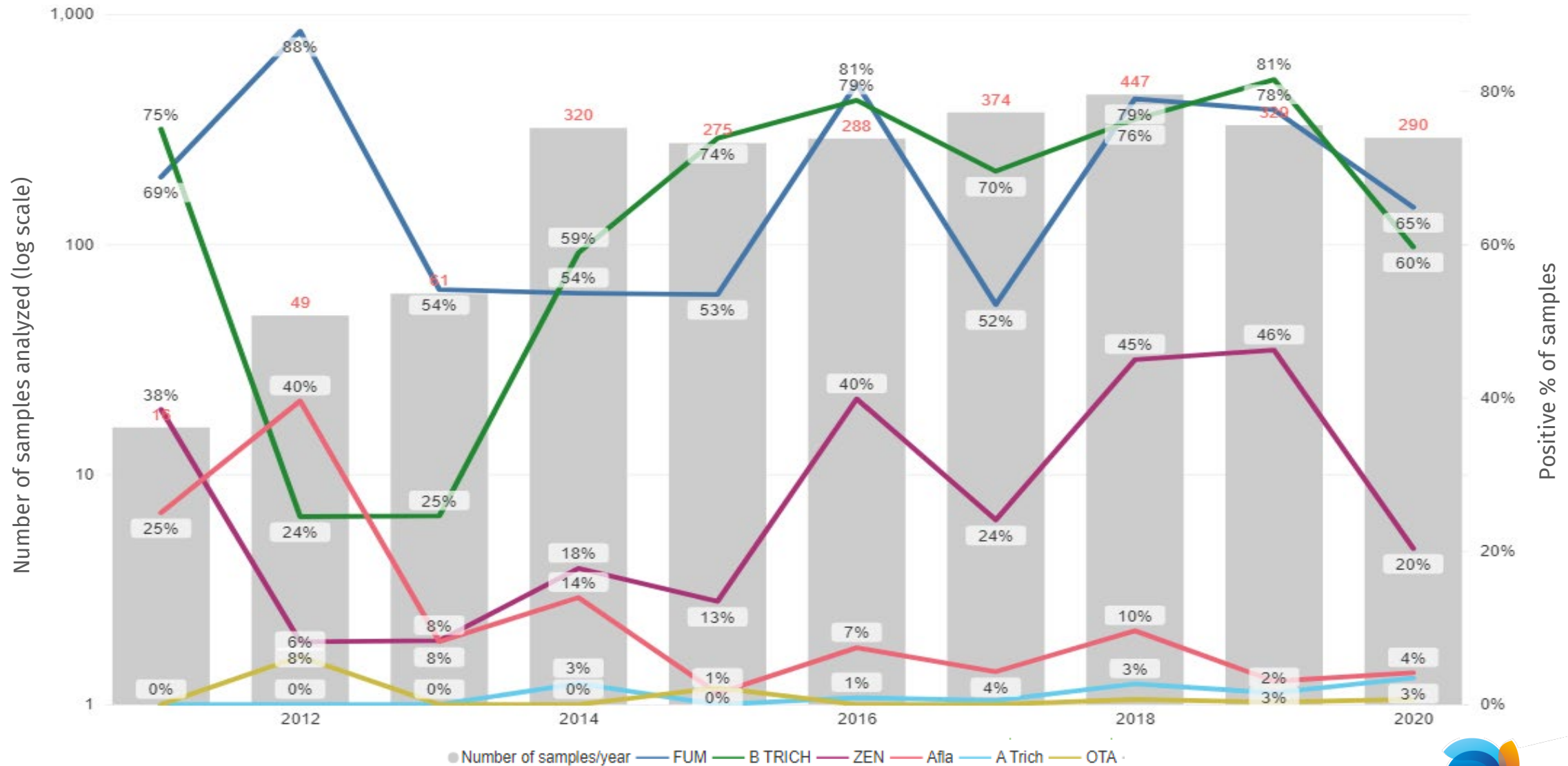
LC-MS/MS



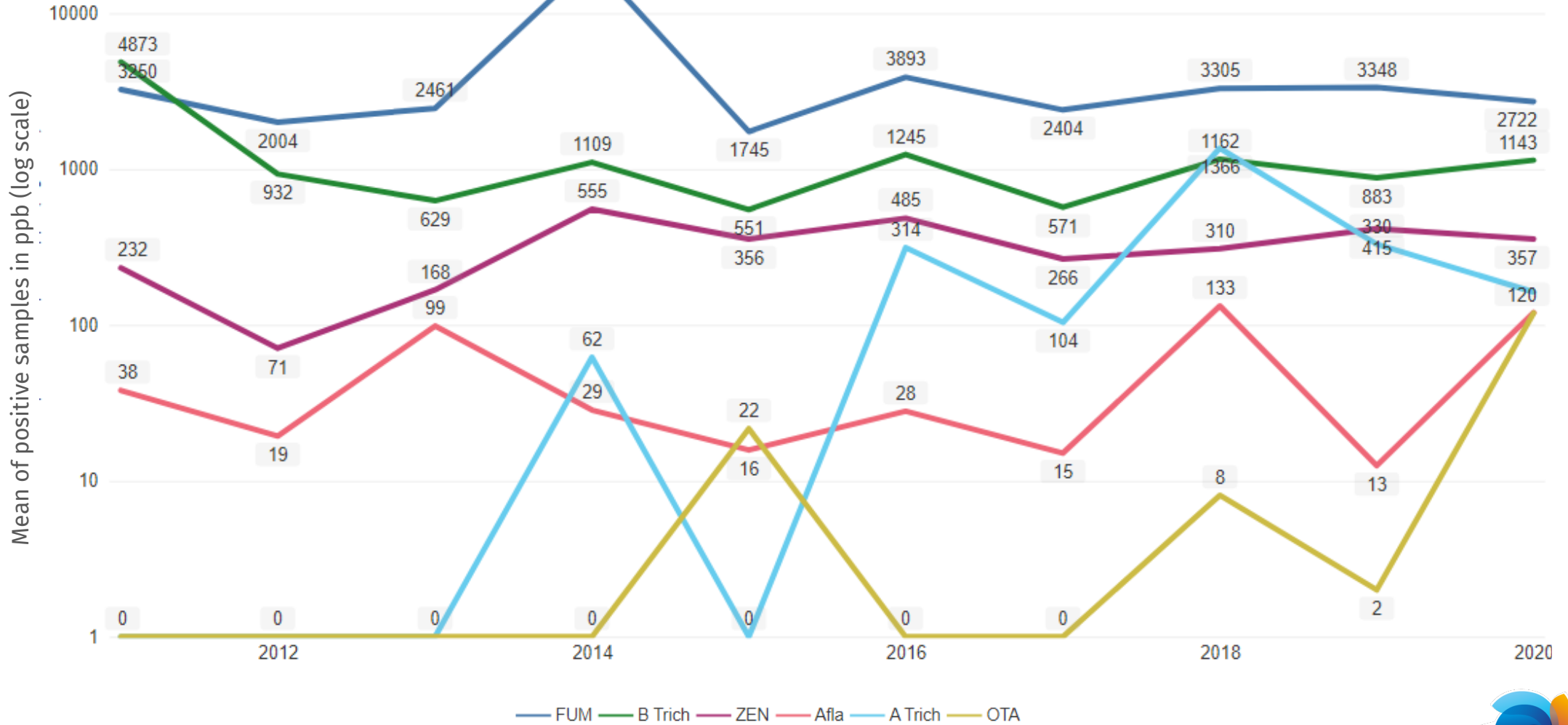
2 Labs

Mycotoxin Group	Mycotoxins	Limit of Detection (ppb)
Aflatoxins (AFLA)	Aflatoxin B1	1.3
	Aflatoxin B2	1.2
	Aflatoxin G1	1.1
	Aflatoxin G2	1.6
A-Trichothecenes (A-Trich)	T-2	100.0
	HT-2	100.0
	Neosolaniol	100.0
	Diacetoxyscirpenol (DAS)	100.0
B-Trichothecenes (B-Trich)	Deoxynivalenol (DON/Vomitoxin)	100.0
	Acetyl-deoxynivalenol (A-DON)	100.0
	Nivalenol (NIV)	100.0
	Fusarenon X (FUS-X)	100.0
Fumonisin (FUM)	Fumonisin B1	100.0
	Fumonisin B2	100.0
	Fumonisin B3	100.0
Zearalenone (ZEN)	Zearalenone (ZEN)	51.7
Ochratoxin A (OTA)	Ochratoxin A (OTA)	1.1

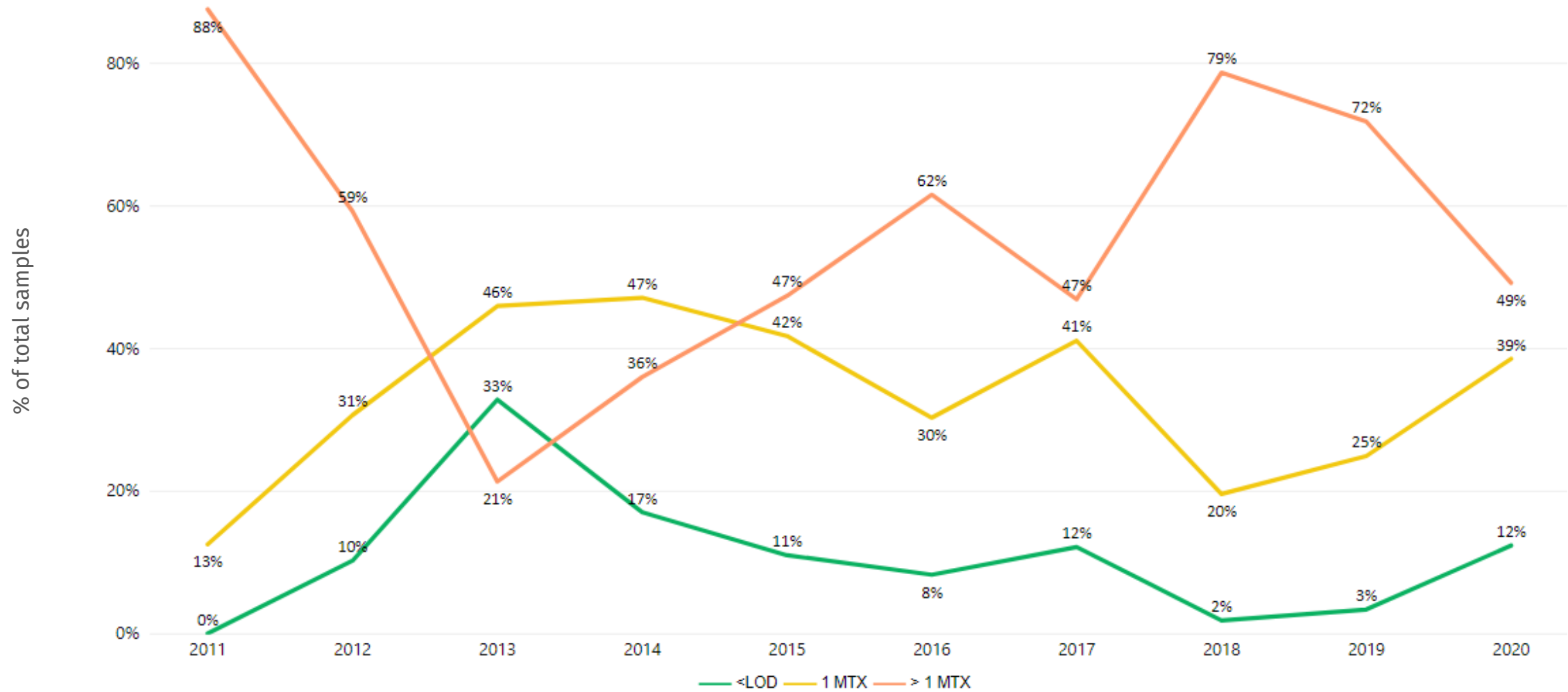
# Occurrence Trend in US Corn



# Mean of Positives Trend in US Corn

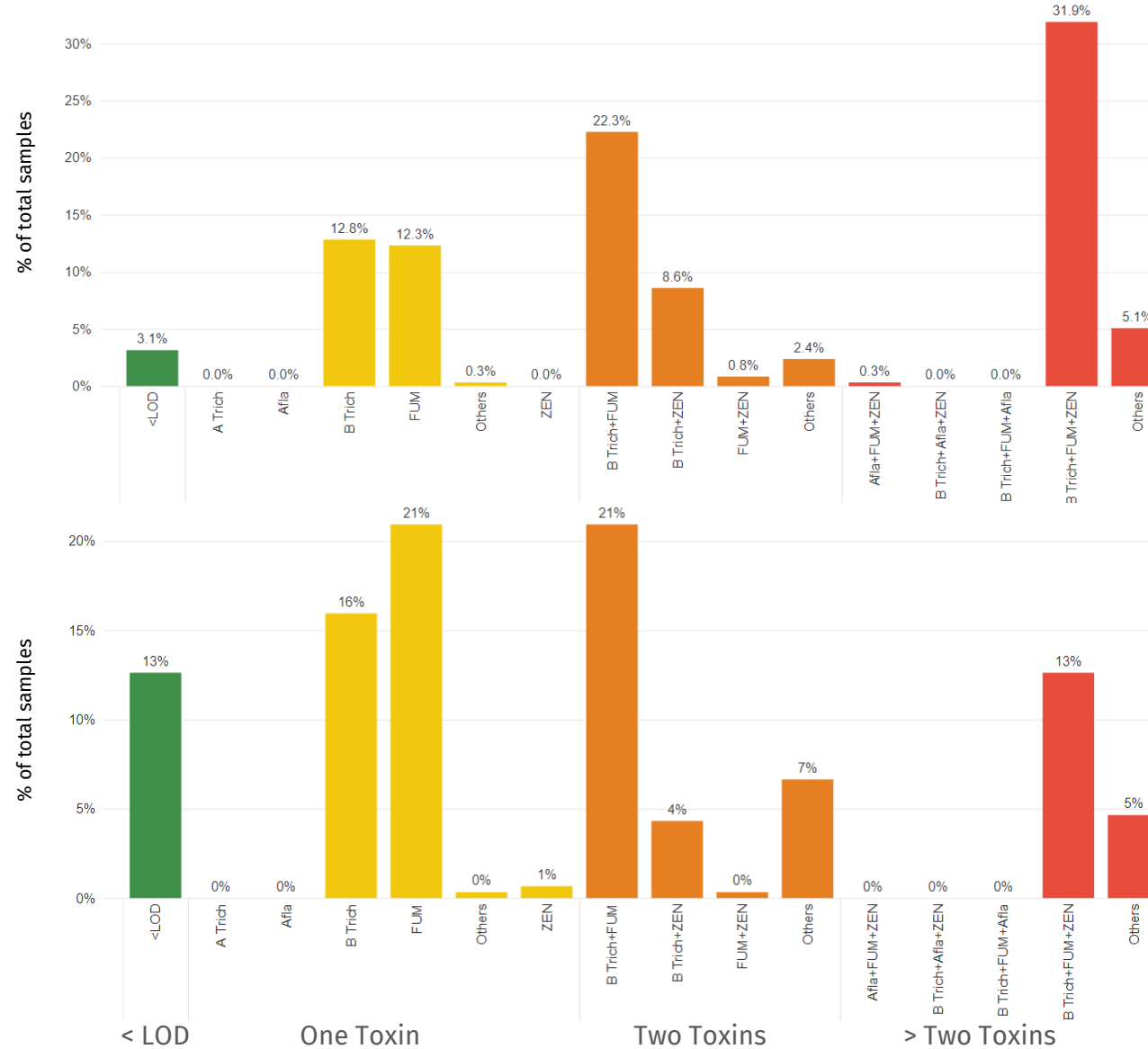


# Mycotoxin Co-occurrence Trend in US Corn



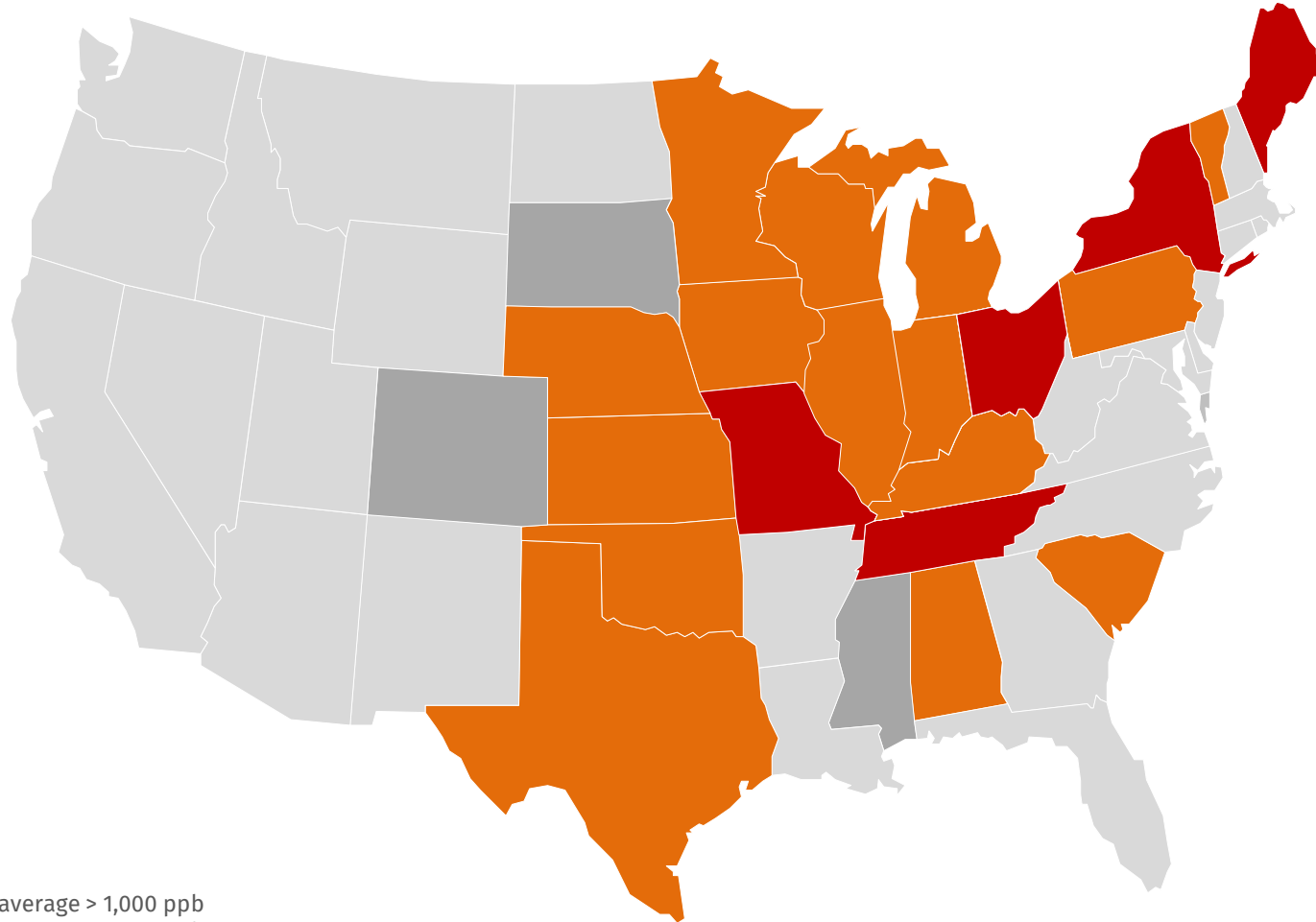
# Mycotoxin Co-occurrence 2019 vs. 2020 in US Corn

2019



2020

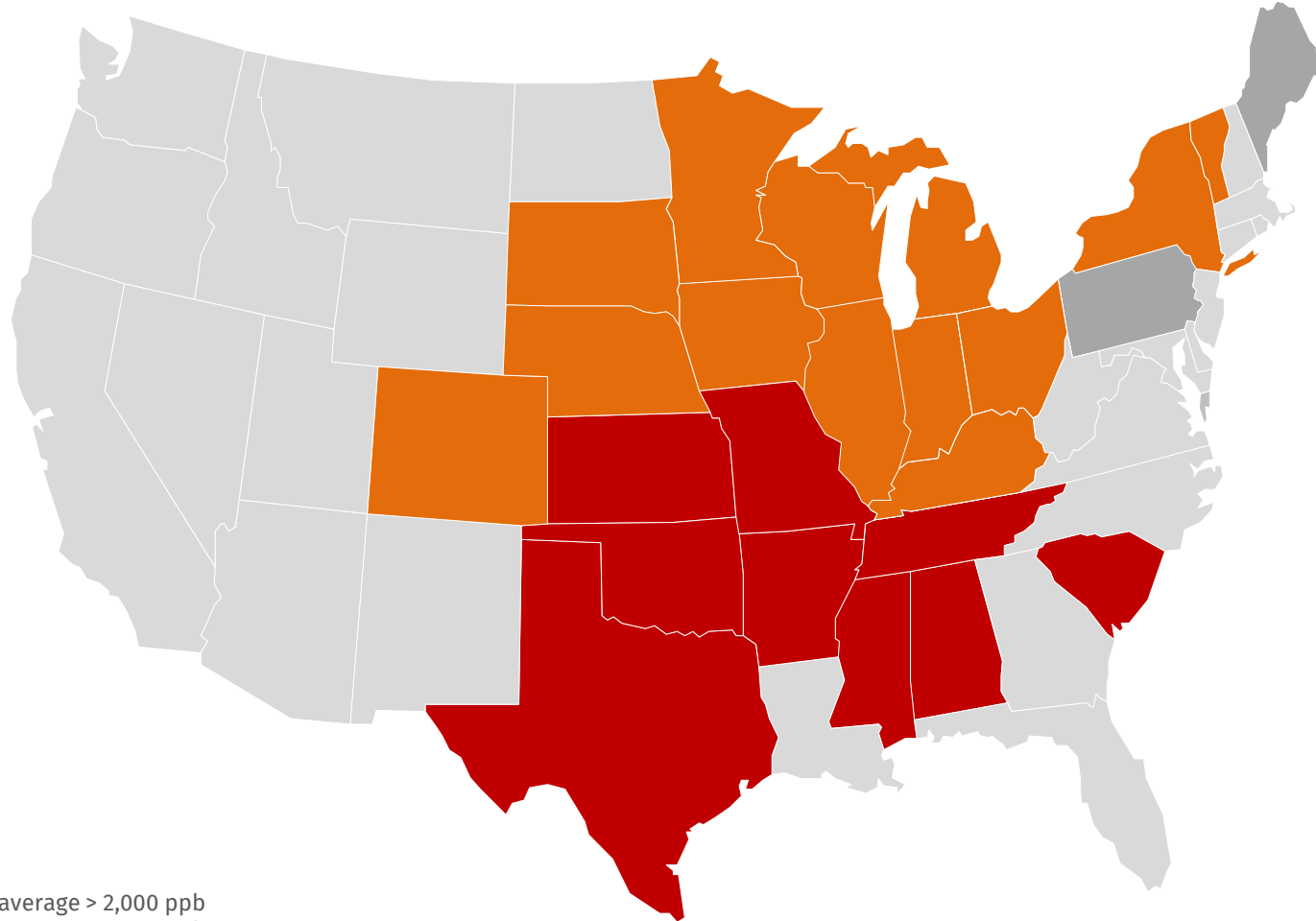
# 2020 Corn Risk by State - B Trich



- State with average > 1,000 ppb
- State with average < 1,000 ppb
- State with samples < LOD (100 ppb)
- No sample submitted

State	Number of Samples	% Positive Samples	Avg of Positive Samples
OH	7	100%	11313
ME	1	100%	2884
MO	25	60%	1078
NY	3	100%	1030
TN	4	50%	1013
IL	21	95%	993
SC	6	50%	975
MI	11	64%	762
IN	19	95%	749
WI	35	91%	718
OK	9	33%	572
NE	38	55%	490
IA	31	23%	487
MN	27	48%	483
KY	6	100%	438
AL	8	38%	415
PA	2	100%	240
VT	2	100%	225
KS	13	23%	213
TX	6	17%	110
AR	1	0%	0
CO	7	0%	0
MS	1	0%	0
SD	2	0%	0

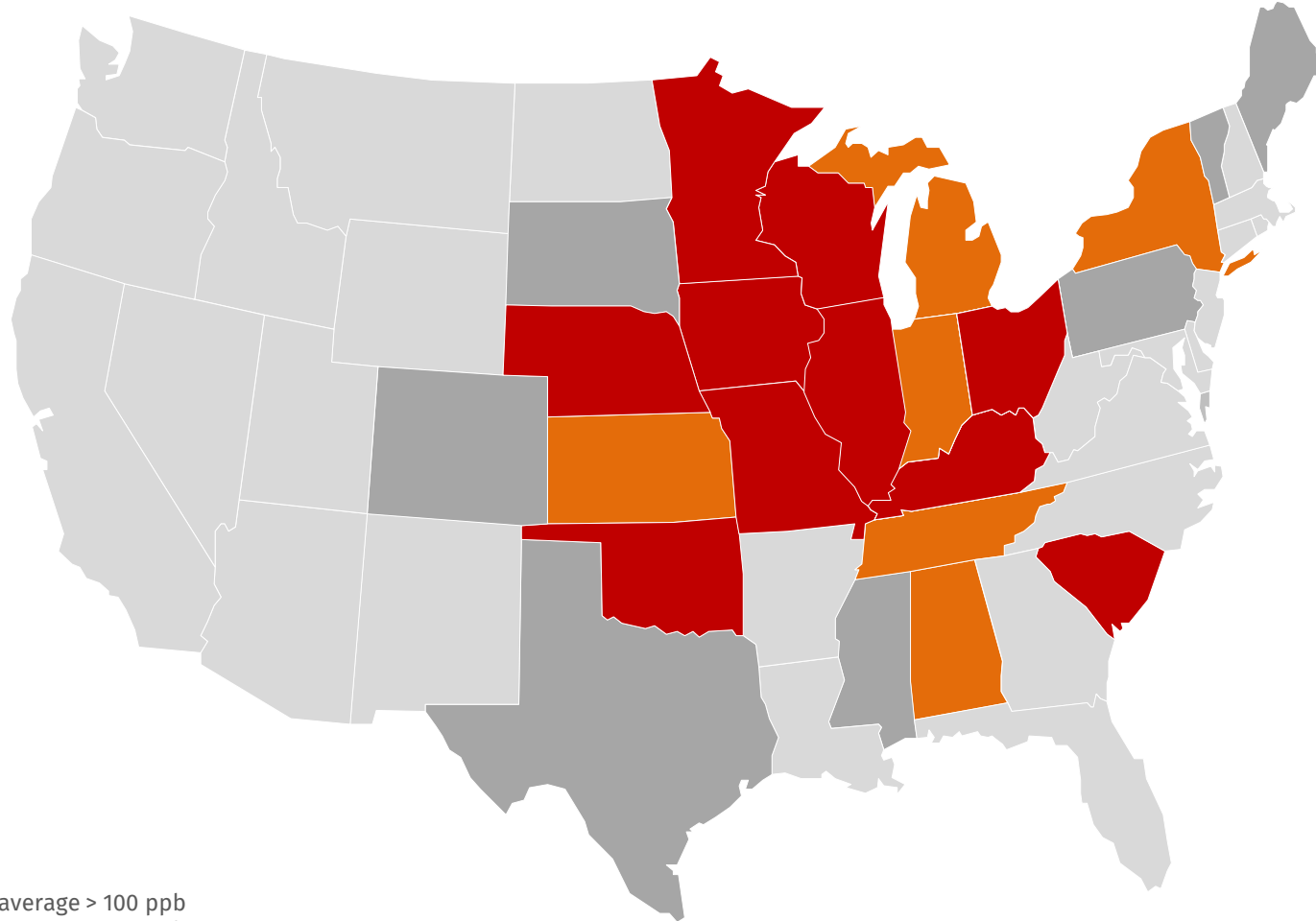
# 2020 Corn Risk by State - FUM



- State with average > 2,000 ppb
- State with average < 2,000 ppb
- State with samples < LOD (100 ppb)
- No sample submitted

State	Number of Samples	% Positive Samples	Avg of Positive Samples
KS	13	100%	11377
MS	1	100%	8200
MO	25	96%	7267
TX	6	100%	6533
OK	9	78%	3571
AL	8	100%	2763
AR	1	100%	2300
TN	4	100%	2200
SC	6	100%	2183
KY	6	100%	874
NE	38	63%	836
MN	27	26%	807
CO	7	88%	800
VT	2	50%	700
WI	35	49%	592
OH	7	71%	563
NY	3	67%	500
IL	21	71%	480
IN	19	58%	382
MI	11	45%	280
IA	31	55%	276
SD	2	50%	200
ME	1	0%	0
PA	2	0%	0

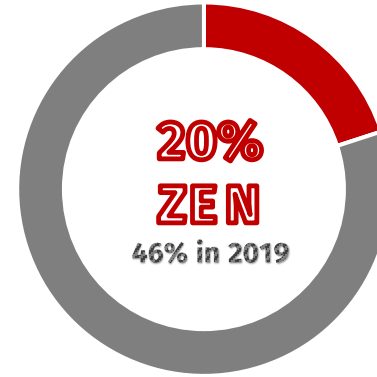
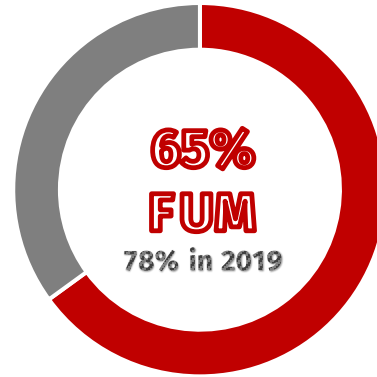
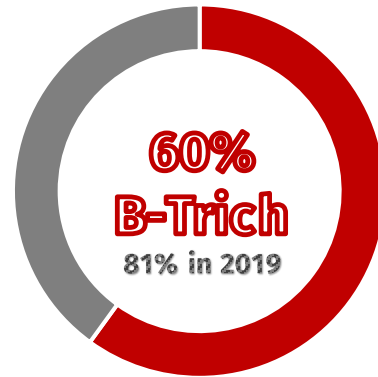
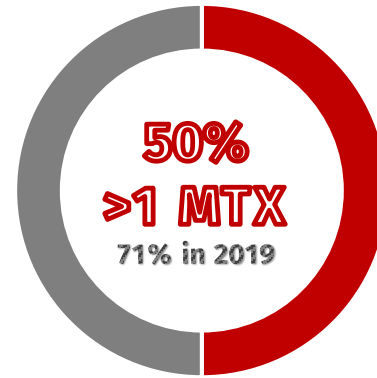
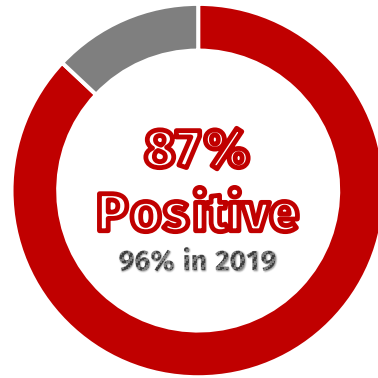
# 2020 Corn Risk by State - ZEN



- State with average > 100 ppb
- State with average < 100 ppb
- State with samples < LOD (51.7 ppb)
- No sample submitted

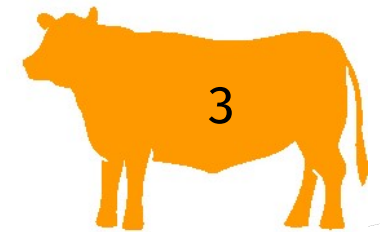
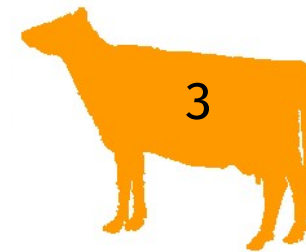
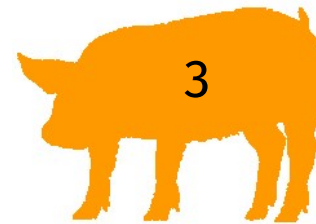
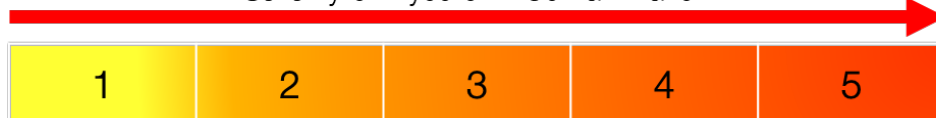
State	Number of Samples	% Positive Samples	Avg of Positive Samples
OH	7	100%	1039
SC	6	17%	891
MO	25	28%	437
WI	35	17%	393
IL	21	48%	338
NE	38	18%	257
MN	27	11%	209
KY	6	33%	125
OK	9	11%	118
IA	31	10%	108
AL	8	38%	96
TN	4	25%	86
IN	19	16%	82
KS	13	8%	79
NY	3	33%	65
MI	11	18%	65
AR	1	0%	0
CO	7	0%	0
ME	1	0%	0
MS	1	0%	0
PA	2	0%	0
SD	2	0%	0
TX	6	0%	0
VT	2	0%	0

# Mycotoxin Survey Summary - 2020 US Corn



## Forecasted risk for livestock production:

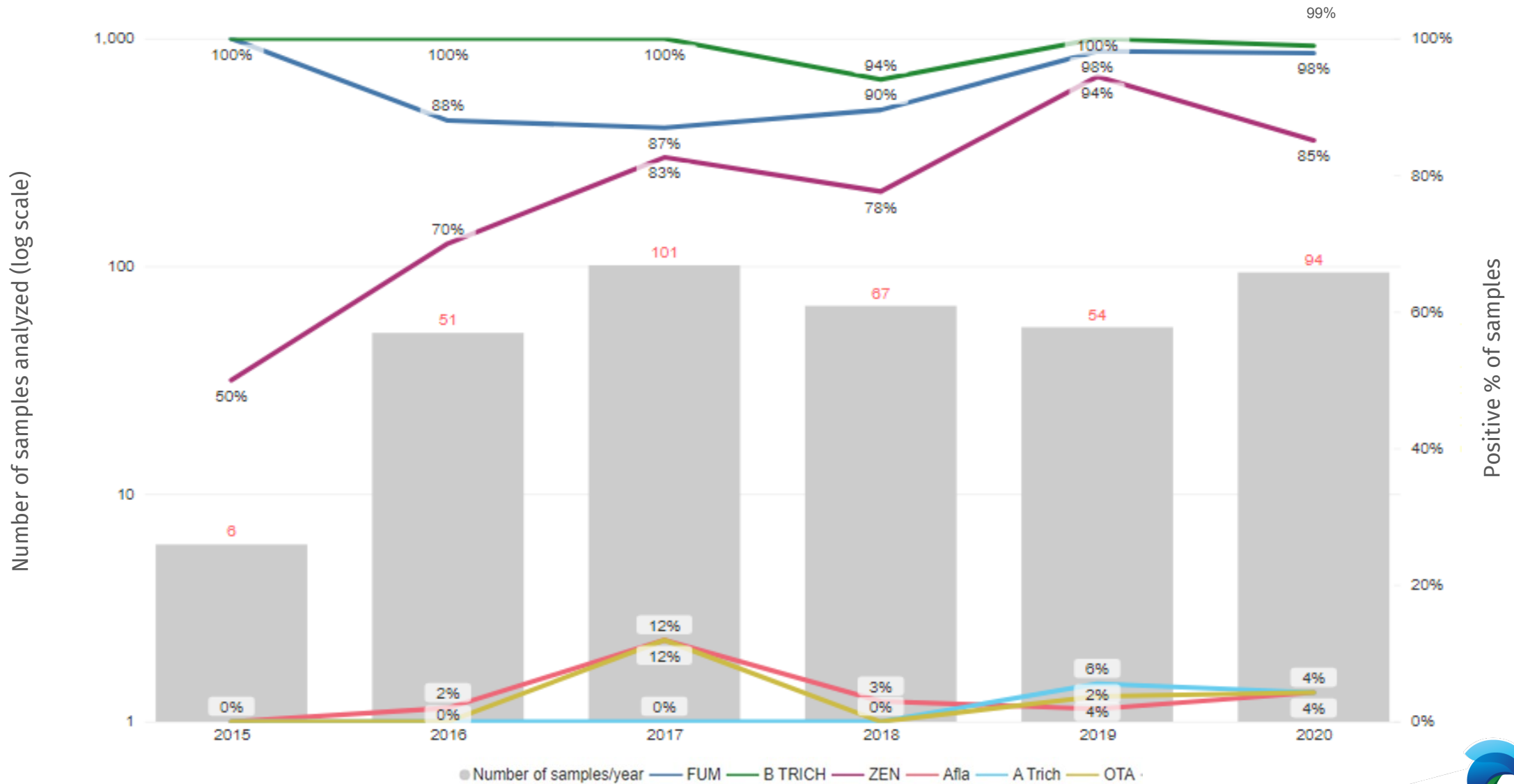
Severity of Mycotoxin Contamination



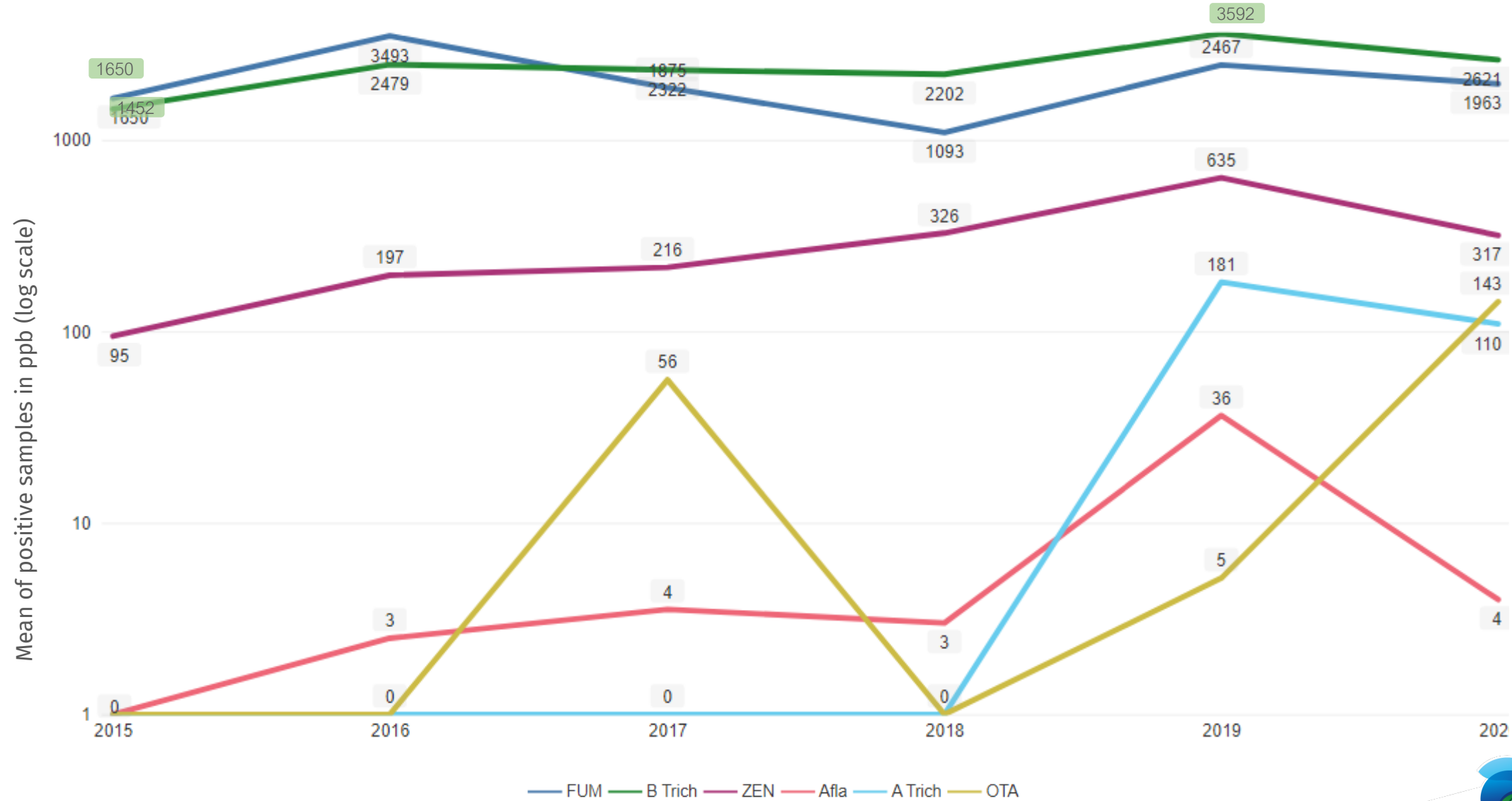
# Corn DDGs



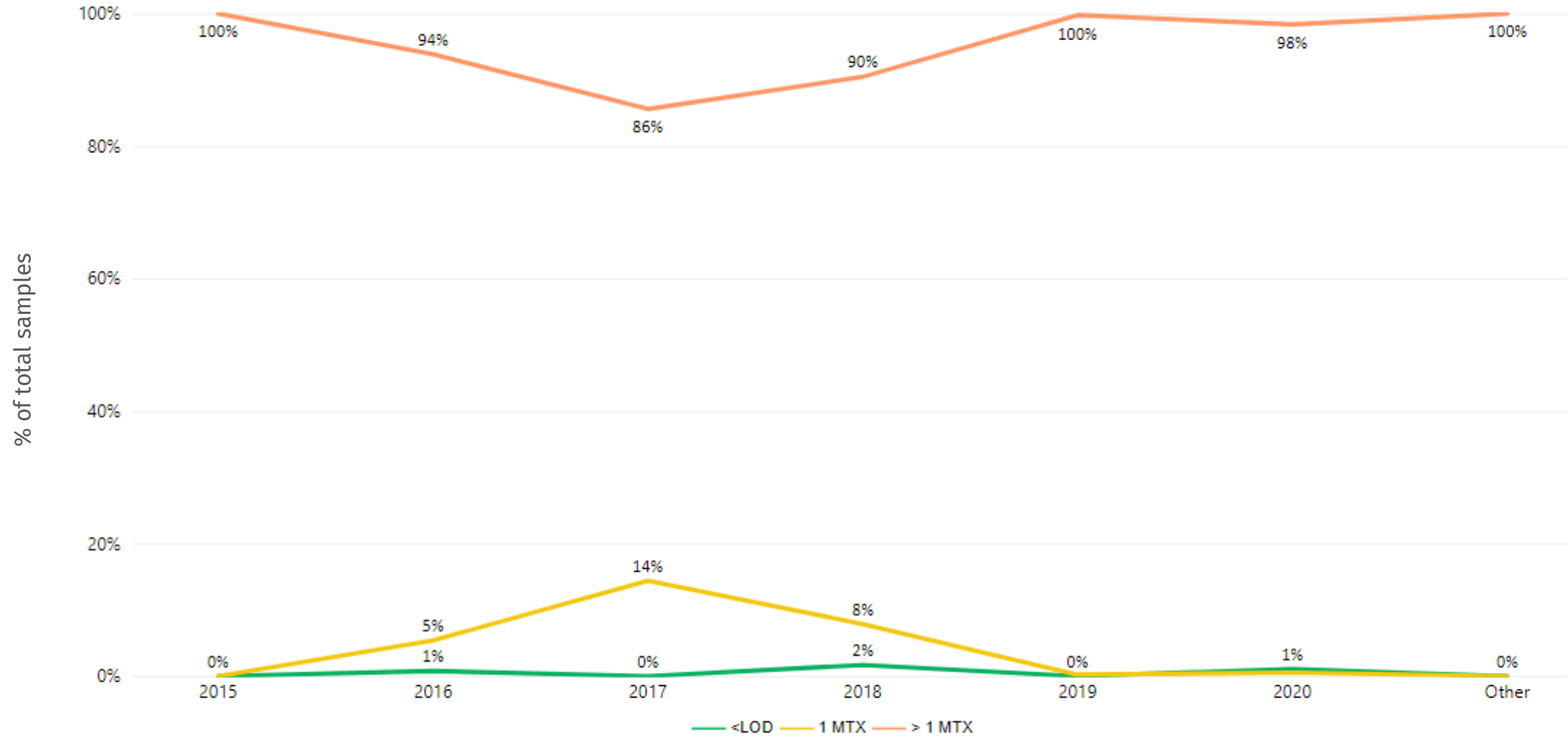
# Occurrence Trend in US Corn DDGs



# Mean of Positives Trend in US Corn DDGs

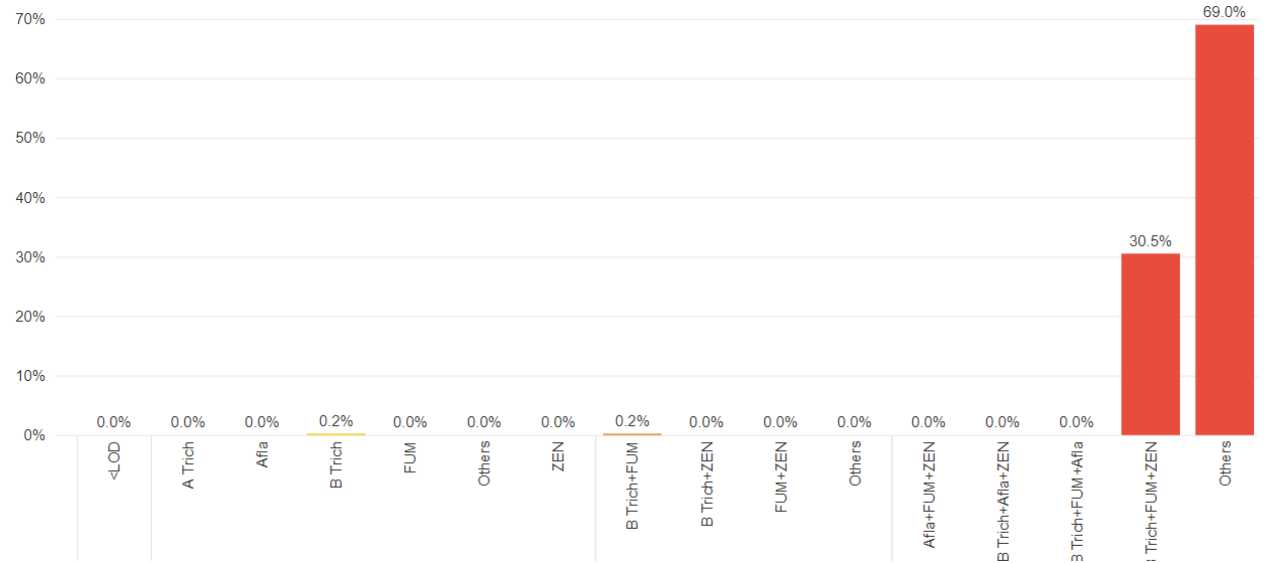


# Co-occurrence Trend in US Corn DDGs

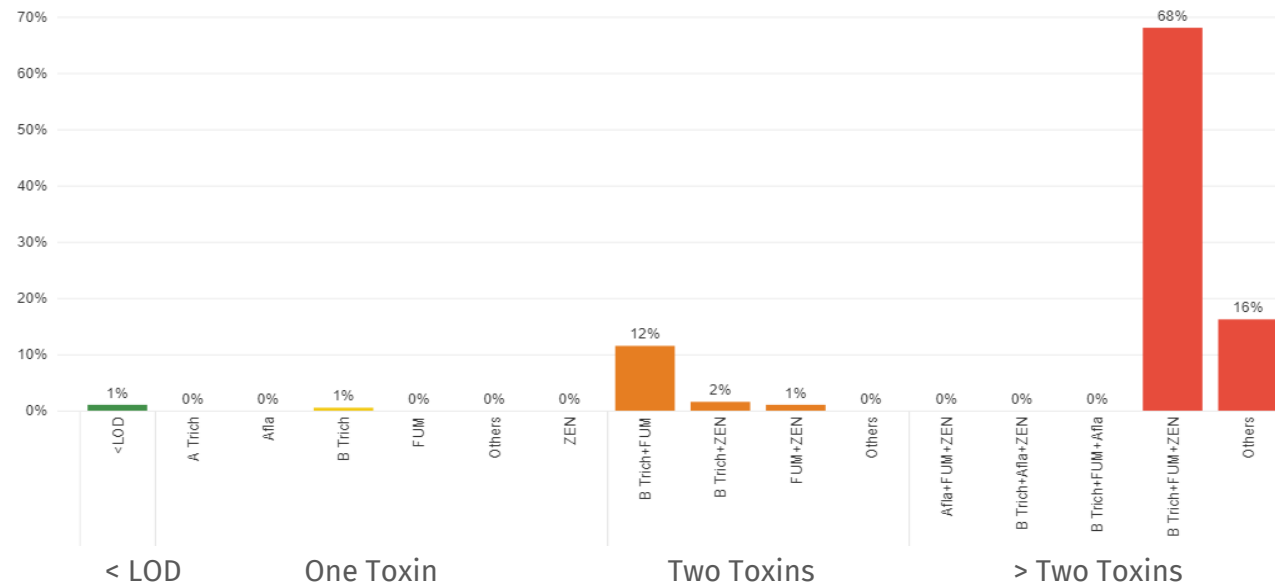


# Co-occurrence 2019 vs. 2020 in US Corn DDGs

2019



2020



< LOD

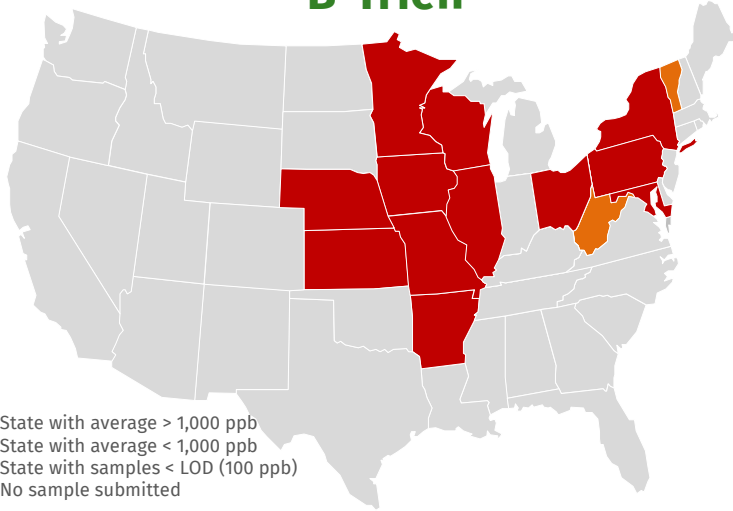
One Toxin

Two Toxins

> Two Toxins

# 2020 Corn DDGs Risk by State

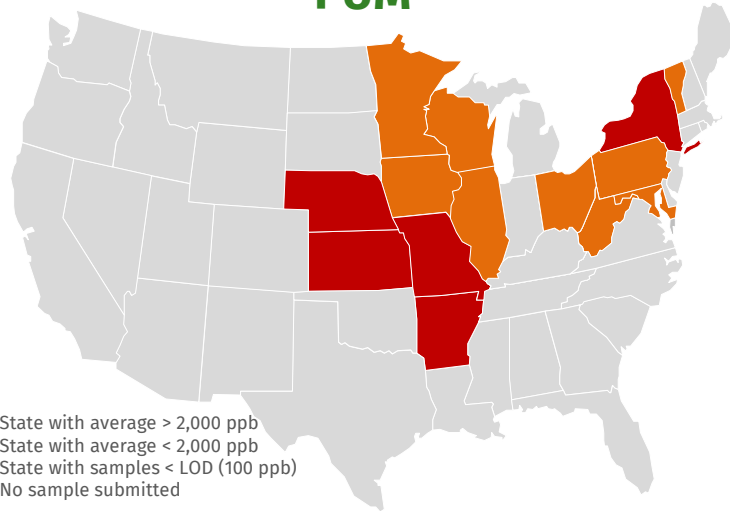
## B-Trich



- State with average > 1,000 ppb
- State with average < 1,000 ppb
- State with samples < LOD (100 ppb)
- No sample submitted

State	Number of Samples	% Positive Samples	Avg of Positive Samples
OH	4	100%	12943
KS	1	100%	5318
PA	2	100%	4517
NY	1	100%	3003
MD	1	100%	2717
WI	21	100%	2585
MN	5	100%	2514
NE	9	100%	2498
AR	1	100%	2472
MO	4	100%	2081
IL	6	100%	1875
IA	36	97%	1605
WV	1	100%	266
VT	1	100%	174

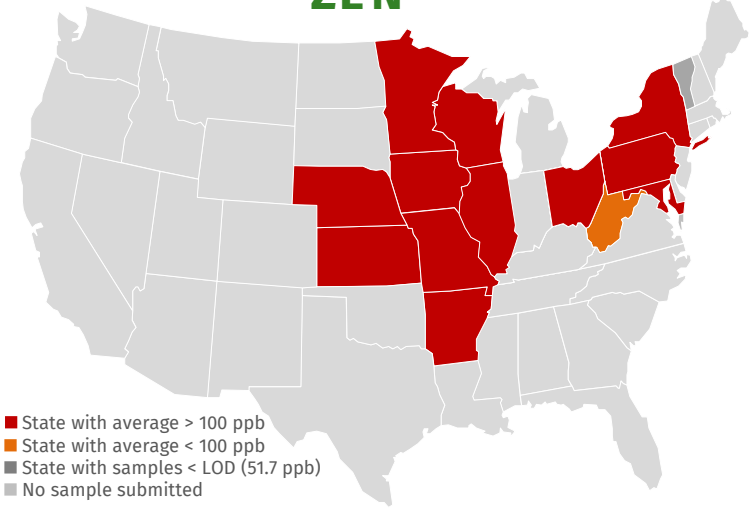
## FUM



- State with average > 2,000 ppb
- State with average < 2,000 ppb
- State with samples < LOD (100 ppb)
- No sample submitted

State	Number of Samples	% Positive Samples	Avg of Positive Samples
AR	1	100%	19200
KS	1	100%	14200
NE	9	100%	3498
NY	1	100%	2200
IL	6	100%	2150
MO	4	100%	2075
IA	36	100%	1781
WI	21	100%	957
MD	1	100%	900
PA	2	100%	900
OH	4	100%	725
MN	5	60%	400
WV	1	100%	400
VT	1	100%	200

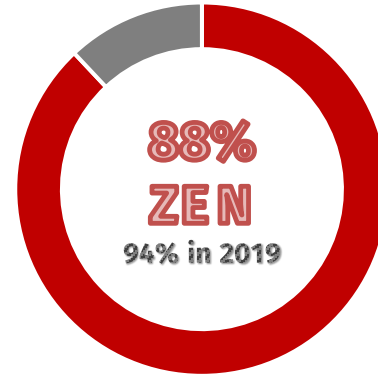
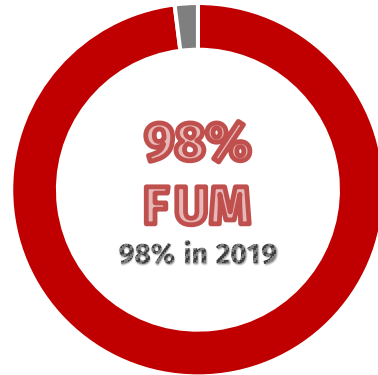
## ZEN



- State with average > 100 ppb
- State with average < 100 ppb
- State with samples < LOD (51.7 ppb)
- No sample submitted

State	Number of Samples	% Positive Samples	Avg of Positive Samples
AR	1	100%	932
KS	1	100%	816
MO	4	75%	676
OH	4	100%	551
NE	9	56%	500
NY	1	100%	342
MN	5	80%	323
IA	36	81%	274
MD	1	100%	269
WI	21	100%	254
PA	2	100%	190
IL	6	100%	173
WV	1	100%	96
VT	1	0%	0

# Mycotoxin Survey Summary - 2020 US Corn DDGs



## Forecasted risk for livestock production:

Severity of Mycotoxin Contamination



# Summary

- Adsorption alone can't be effective for all mycotoxins since not all mycotoxins are the same.
- Non-planar mycotoxins can not be adsorbed (bound) effectively.
- Microbial and enzymatic technologies have much higher efficacy in detoxifying non-planar toxins.
- Mycotoxin mitigation strategies should also include liver health and immune support components.
- Multiple strategies have to be used to counteract diverse and multiple mycotoxin challenges
  - **Adsorption + Biotransformation + Bioprotection**

# Questions?

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Thank you!



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affect **EVERYONE!**

