Agrarian® SOLUTIONS

RISE

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A Letter from Agrarian Solutions® President

Greetings from Agrarian! We are already wrapping up the 1st quarter of 2023 and the days seem to fly by. Optimism is running high as we are having one of the strongest starts to the year that we have ever had. We were also pleased to release our new BioFresh® Microbial Gel and Convert™ BIG Calf Powder. We are already seeing significant sales and very positive reports from the field.

We are experiencing some significant market penetration with our core products as people continue to see not only the benefits when mycotoxins are present, but the overall health and improvement to the immune system through a healthier gut. These products are performing well with dairy cows in the U.S. as well as swine in Asia, and poultry in the Middle East. Agrarian product programs are improving the health and performance of camels in the UAE, dairy cows in Quebec, and chickens in Egypt…and that is just to mention a few.

In addition to our high-performing family of products powered by Agrarian's L-form technology, we are exploring some new products that could provide significant benefits to the end-user. All this is great news, but what sets Agrarian apart is the relationships we have with our co-workers, customers, and suppliers all over the world. It is the fuel that drives our engine, and it is what makes us want to come to work every day!

Those of us at Agrarian are always eager to hear from our partners and colleagues with suggestions and ideas. This is why we exist…it is our desire to see others succeed. We are excited about the future with you, and truly believe that our greatest days are just ahead. Thank you for being on the Agrarian team!

Mark Lantz
President

we exist to help others succeed

Agrarian Solutions® Team & Staff Updates

MARK CARPENTER Executive Vice President and General Manager

We are extremely pleased to welcome Mark Carpenter to the Agrarian team as Executive Vice President and General Manager. Mark brings a wealth of talent and experience to the team. Many of you know Mark and have witnessed his ongoing leadership with Premier Select Sires. Mark brings a strong vision and the strategic acumen that will be instrumental in reaching our future goals. Mark is a great fit and a welcome addition to the Agrarian team.

Mark Lantz
President

Rob Hamaker
Vice President, Sales & Marketing

Mark Carpenter
Executive Vice President, General Manager

John Doerr, Ph.D., PAS, Dpl. ACAP
Vice President, Science & Technology

Larry Roth,, Ph.D., PAS
Vice President of Nutrition

Nic Bradley
Director of Operations

Scott Zehr
Business Development Manager

Chad Christensen
Regional Sales Manager Midwest Plains Region

Dan Hoying
Regional Sales Manager Midwest Region

Jamie Peth
Regional Sales Manager West Coast

Kurt Marquardt
Sales Representative East Asia

Kelbi Veenstra
Office Manager

Mary Taylor
Administrative Assistant

Kelly Bristle
ALL IN Community Manger

Written By: Larry Roth,, Ph.D., PAS *Vice President of Nutrition*

Comparisons of Various Products for Binding Efficiency of Mycotoxins, Amino Acids and Vitamins

Several products are marketed for their ability to bind mycotoxins and thereby protect food-producing animals from the harmful effects of mycotoxins. Recent research has raised concerns about the inability of these products to adequately protect animals by sequestering mycotoxins, and may in fact reduce the availability of amino acids and vitamins.

Table 1. *In vitro* Efficacy of Mycotoxin Binding by Various Mycotoxin Binder Types1

Table 1: *The adsorption of different mycotoxin binders against most common mycotoxins (average adsorption ± SEM).*

Mycotoxin Binders	Aflatoxin B1	Deoxynivalenol	Fumonisin	Ochratoxin A	T-2 toxin	Zearalenone	Average
Activated carbon	$93^{a} \pm 0.8$	$69^{a} \pm 0.8$	$83^{a} \pm 1.7$	$88^{a} \pm 1.8$	53 ± 7.9	$93^{a} \pm 1.6$	**$81^{a} \pm 0.4$**
Bentonite	$86^{a,x} \pm 0.3$	$18^{b,y} \pm 1.4$	$32^{b,y} \pm 4.2$	$30^{b,y} \pm 0.6$	$22^{y} \pm 6.9$	$29^{b,y} \pm 1.1$	$45^{b} \pm 0.2$
Clinoptilolite	$75^{ab,x} \pm 1.5$	.	.	.	$29^{xy} \pm 15.9$	$14^{b,y} \pm 2.8$	$32^{b} \pm 1.2$
HSCAS[1]	$83^{a,x} \pm 0.8$	$11^{b,y} \pm 1.6$	$52^{ab,xy} \pm 2.8$	$43^{ab,xy} \pm 5.1$	$32^{xy} \pm 12.6$	$52^{b,x} \pm 1.4$	$48^{b} \pm 0.5$
Montmorillonite	$88^{a,x} \pm 1.0$	$9^{b,y} \pm 6.3$	$42^{ab,y} \pm 12.7$	$26^{ab,y} \pm 11.9$	$24^{y} \pm 13.1$	$47^{b,y} \pm 1.7$	$48^{b} \pm 0.8$
Sepiolite	$95^{ab} \pm 8.3$	$13^{ab} \pm 12.6$	.	.	.	$39^{ab} \pm 11.3$	$46^{b} \pm 3.9$
Zeolite	$61^{ab,x} \pm 1.5$	$10^{b,y} \pm 2.9$	$26^{b,x} \pm 2.3$	$44^{ab,x} \pm 1.3$	$5^{x} \pm 13.5$	$33^{b,x} \pm 2.1$	$32^{b} \pm 0.5$
Yeast cell wall	$49^{b} \pm 0.4$	$20^{b} \pm 1.2$	$30^{b} \pm 2.5$	$43^{b} \pm 0.4$	28 ± 3.8	$48^{b} \pm 0.4$	$34^{b} \pm 0.2$
Average	**$77^{x} \pm 0.1$**	**$23^{z} \pm 0.5$**	$45^{yz} \pm 1.0$	$47^{y} \pm 0.3$	$31^{yz} \pm 2.3$	$50^{y} \pm 0.3$	

* * Different superscripts in the same column indicate a significant effect between binders ($P < 0.05$). * * Different superscripts in the same row indicate a significant effect between mycotoxins ($P < 0.05$). [1]HSCAS = Hydrated sodium calcium aluminosilicate.

Kihal et al (2022) conducted a meta-analysis of 68 peer-reviewed research studies to determine the percentage mycotoxin adsorption by various mycotoxin binder products (MTB). The analysis found that mycotoxin adsorption is highly variable, with aflatoxin being the highest and deoxynivalenol being the least. In addition, activated carbon (charcoal) was the most effective MTB across mycotoxin type; however, considerable variation in pore size exists due to source and processing.

Earlier research (Kihal et al., 2020) evaluated adsorption by the MTB for vitamins and amino acids. When the water- and fat-soluble vitamins D and E were incubated together, the MTB adsorption average 35% for the water-soluble vitamins and 37.2% of the vitamin E, while minimal vitamin D was bound. The researchers incubated the amino acids lysine, methionine, threonine and tryptophan together with the MTB and found that 19% of the amino acids were bound.

Summary

Common MTB are ineffective for adsorption of mycotoxins, except aflatoxin; further, the MTB did bind water-soluble vitamins and vitamin E, as well as amino acids. Rations including common MTB should be adjusted for reduced vitamin and amino acid availability.

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[1]Kihal et al (2022). J. Anim. Sci. 100:1-14.

[2]Kihal et al (2020). J. Dairy Sci. 103:3125-3132.

Written By: Larry Roth,, Ph.D., PAS *Vice President of Nutrition*

Mycotoxin Summary Results

Mycotoxin summary results for October 1, 2022 through March 31, 2023 are displayed in figures 1 and 2 for TMR and corn silage samples, respectively. Generally, Eastern States, with higher rainfall patterns, posted higher mycotoxin levels than the Plains States experiencing drier conditions or drought.

Ohio's TMR assay results were most problematic with a combination of elevated DON and zearalenone readings to affect both digestion/nutrient absorption and reproductive success. Interestingly, Ohio's corn silage zearalenone levels were not that concerning, suggesting that by-products being fed could be significant zearalenone contributors to the Ohio TMR values. Conversely, Michigan TMR mycotoxin levels were somewhat lower than what might be predicted from the state's corn silage assays.

High fumonisin corn silages values were observed along the Eastern Seaboard from South Carolina through North Carolina, Virginia and into Maryland and Pennsylvania. Fortunately, other feed ingredients must have been relatively low in fumonisin to create the safe levels seen in the TMR samples.

I encourage you to participate in the Agrarian mycotoxin testing program. We are emphasizing recording crop year for the corn silage samples to identify year to year changes, as well as variability through the year. In addition, please consider the value of monthly monitoring of TMR and corn silage for mycotoxin variation. Proactive sampling may help to identify challenges before escalating. Contact your Agrarian representative for the latest on mycotoxin evaluation.

TMR MYCOTOXIN VALUE STATE AVERAGES (all values in ppb) | OCTOBER 1, 2022 - MARCH 31, 2023

State	Zearalenone	DON Average	Fumonisins Average	T-2 Toxin Average
IL	100	1225	867	nd
IN	nd	2030	nd	nd
KS	110	265	567	nd
MD	85	1959	333	nd
MI	180	2005	150	nd
MN	83	420	125	nd
NE	nd	370	600	nd
NY	148	1707	233	250
NC	225	1755	1550	nd
OH	776	3695	150	nd
PA	169	1619	397	nd
SD	120	1183	100	nd
TN	nd	260	nd	nd
TX	140	322	188	nd
UT	nd	195	200	nd
VA	92	1128	437	nd
WA	nd	270	100	nd
WI	139	1836	138	97

nd = none detected
= low
= medium
= high
ppb = parts per billion

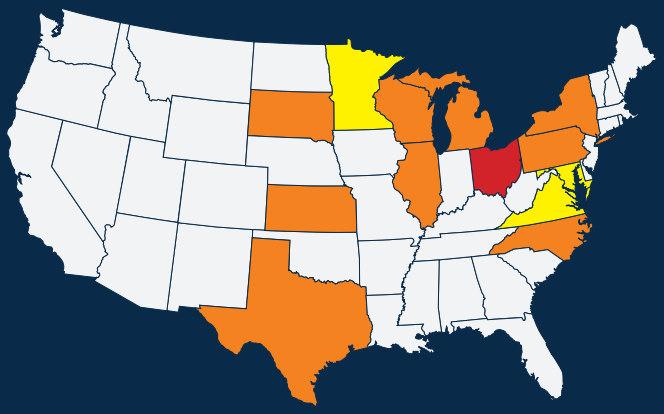
START DATE **October 1, 2022** | END DATE **March 31, 2023**

NO. OF SAMPLES 277

1 DON = DON + 3-Acetyl-DON + 15-Acetyl-DON; FUM = fumonisin B1 + fumonisin B2; T-2 = T-2 toxin + HT-2 Toxin

TMR MYCOTOXIN VALUE STATE AVERAGES (all values in ppb) | OCTOBER 1, 2022 - MARCH 31, 2023

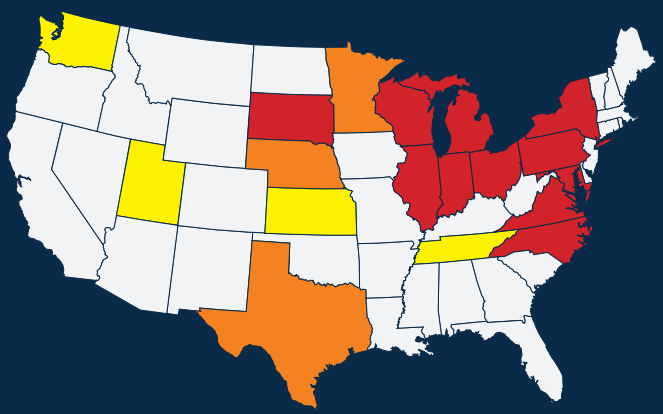
Zearalenone



ppb (parts per billion)

nd <100 100-300 301+

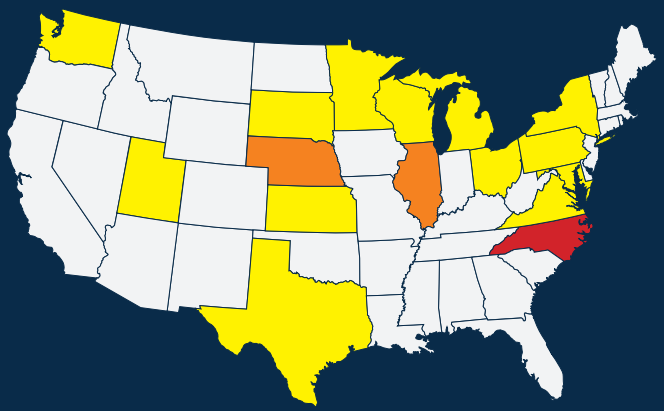
DON Average



ppb (parts per billion)

nd <300 300-1000 1001+

Fumonisins Average



ppb (parts per billion)

nd <600 600-1500 1501+

T-2 Toxin Average

ppb (parts per billion)

nd <75 75-150 151+

October 1, 2022 - March 31, 2023 State Averages (all values in ppb)

CORN SILAGE VALUE STATE AVERAGES (all values in ppb) | OCTOBER 1, 2022 - MARCH 31, 2023

State	Zearalenone	DON Average	Fumonisins Average	T-2 Toxin Average
AR	nd	nd	6400	nd
ID	nd	nd	nd	nd
IL	nd	550	300	nd
IN	nd	nd	nd	nd
IA	nd	440	100	nd
KS	nd	120	nd	nd
LA	nd	nd	nd	nd
MD	60	620	900	nd
MI	2195	4345	nd	nd
MN	207	1543	185	190
MO	nd	270	nd	nd
NE	nd	nd	nd	nd
NM	nd	nd	nd	nd
NY	135	2072	200	310
NC	575	2909	2340	nd
OH	178	1895	397	305
PA	284	2075	1232	nd
SC	nd	105	1200	nd
SD	nd	nd	nd	nd
TN	nd	nd	2400	nd
VA	238	3821	1107	70
WI	285	3377	360	380

nd = none detected
= low
= medium
= high
ppb = parts per billion

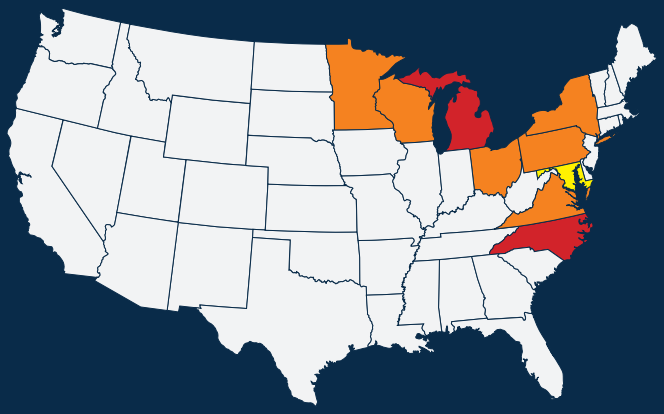
START DATE **October 1, 2022** | END DATE **March 31, 2023**

NO. OF SAMPLES 188

1 DON = DON + 3-Acetyl-DON + 15-Acetyl-DON; FUM = fumonisin B1 + fumonisin B2; T-2 = T-2 toxin + HT-2 Toxin

CORN SILAGE VALUE STATE AVERAGES (all values in ppb) | OCTOBER 1, 2022 - MARCH 31, 2023

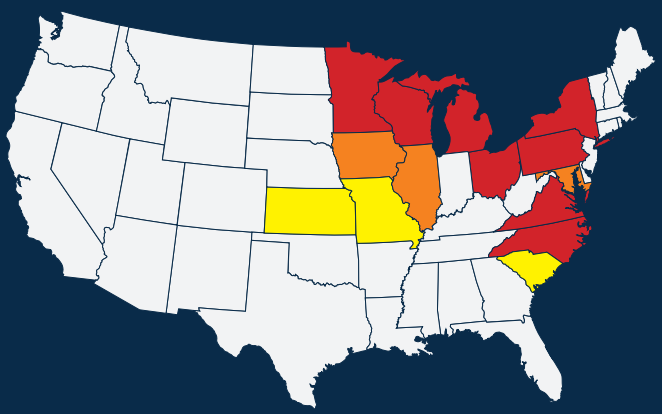
Zearalenone



ppb (parts per billion)

nd | <100 | 100-300 | 301+

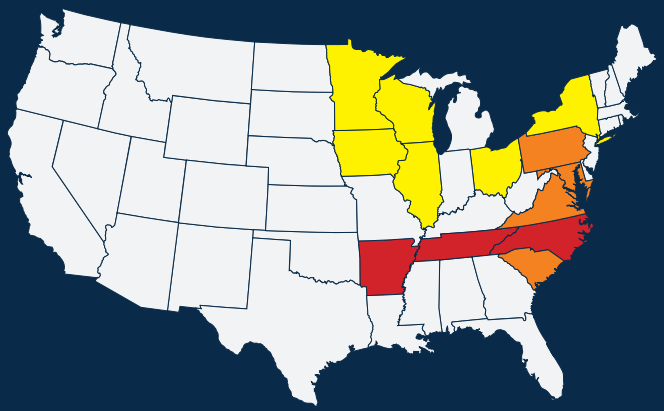
DON Average



ppb (parts per billion)

nd | <300 | 300-1000 | 1001+

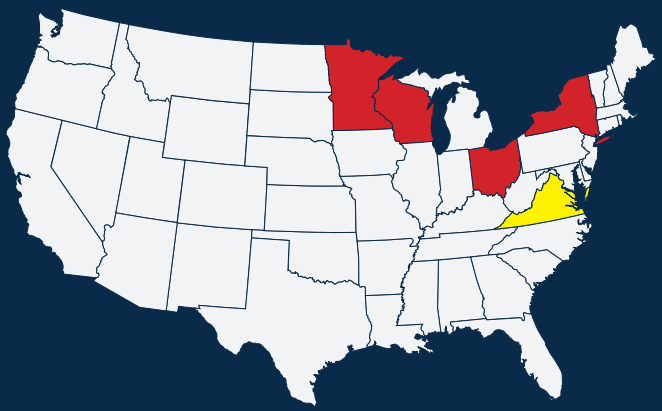
Fumonisins Average



ppb (parts per billion)

nd | <600 | 600-1500 | 1501+

T-2 Toxin Average



ppb (parts per billion)

nd | <75 | 75-150 | 151+

October 1, 2022 - March 31, 2023 State Averages (all values in ppb)

Written By: Larry Roth,, Ph.D., PAS *Vice President of Nutrition*

Introducing Two New Members of the Agrarian Solutions Program:

BIOFRESH® MICROBIAL BOLUS & BIOFRESH® MICROBIAL GEL

These new members of the team are designed with an emphasis on boosting ruminal fermentation and whole digestive tract health. Not all microbial counts are equal, and these products feature 9 billion CFU of beneficial bacteria and yeast per Microbial Bolus or 15 ml Microbial Gel. Both products also utilize egg-based specialized proteins and vitamins to dominate digestive pathogens and enhance immune function.

NEW & ENHANCED

The trusted and long-proven BioFresh® Bolus is now transformed into the BioFresh® Microbial Bolus!

- ✓ Faster bounce-back for fresh cows
- ✓ Restore feed intake and ruminal fermentation for off-feed cows
- ✓ Enhance immune function for challenged and high SCC cows

JOIN THE EXCITEMENT!

Dairy and beef producers are reporting great results with the newly introduced BioFresh Microbial Gel and cite these benefits:

- ✓ Faster return to feed intake after off-feed periods
- ✓ Reduced health treatments needed and fewer re-treats needed

Ideally designed for

- Newly weaned cattle
- Cows at calving
- Assist with health treatments

"We gate cut some sale-barn calves upon arrival at our feedlot and gave one pen the **BioFresh® Microbial Gel** *at initial processing. The Gel pen had 40% fewer pulls, lower medication costs and took off on feed faster than the control pen."*

- Allison Ott - Maize, KS

Contact your Agrarian representative for more information on these key components of the Agrarian Program.

Written By: John Doerr, Ph.D., PAS, Dpl. ACAP *Vice President, Science & Technology*

Mycotoxin Myths

As well-known as mycotoxins have become in animal agriculture, there are some recurring myths needing correction so a producer can make good choices when faced with a possible threat to the herd or flock:

Mycotoxin = aflatoxin. **False**. Aflatoxins are just one kind of over 2000 known mycotoxins. Zero aflatoxin does not mean that there are no mycotoxins. A corollary is that when a test for 6 or so different mycotoxins is performed and the results are negative, the feed tested is 'safe'. False. While we don't see some of the odd mycotoxins very often, or if they are not part of the test panel, the animals may still be at high risk. For example, one called beauvericin has been known for over a decade, but little was known about its effects on domestic species. In a 2016 study, Schoevers [**E. J. Schoevers, et al. (2016). Toxicity of beauvericin on porcine oocyte maturation and preimplantation embryo development. Repro. Toxicol. 65:159-69**] reported that this toxin has serious impact on developing pig embryos shortly after fertilization of the ovum. At this time, we may not have similar studies for poultry or cattle, but the implication that they are also at risk is reasonable. Does your mycotoxin test include beauvericin?

Monogastrics absorb mycotoxins differently that ruminants. **True**. But differences occur within each of those groups. Even within one type of animal (e.g., the dairy cow) different breeds have different susceptibilities to specific mycotoxins. And, within a single breed, there is considerable variation animal to animal on absorption and impact, usually dependent on health, environmental stress, genetics, etc. But, almost without exception, all animals do absorb mycotoxins in the same general region of the intestinal tract.

The rumen will detoxify key mycotoxins. **False**. Early research was performed *in vitro* with rumen fluid; some research confirms that a portion of deoxynivalenol (DON) is converted to a less toxic form. But zearalenone is converted in the rumen to an alternative form that is many times more estrogenic than the primary molecule. And while some research implied aflatoxins might be broken down, one must then explain how a conversion product of aflatoxin in the liver, aflatoxin M_1, can show up in milk.

High levels of mycotoxins are needed to affect animals. **False**. First exposure may be acute...a sudden problem from a portion of one ingredient for a short time...or chronic...low to moderate levels over a long period of time. Each will impact the herd or flock. And, when there are multiple mycotoxins, low amounts generally produce the most noticeable synergistic effects.

If the toxin is below FDA levels, it's okay. **False**. FDA's primary mission is to protect humans from problems related to their food, and secondarily to protect animals from chemicals that may harm them or contaminate the milk, meat, or eggs they produce. But the line between what causes possible harm to a cow or pig and what impairs efficient production is not clear cut. Whether your Holstein produces 90 lbs of milk or 70 lbs of milk is not FDA's concern.

Agrarian® SOLUTIONS

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