



2021 & 4th Quarter

Mycotoxin Report





Welcome

Index

Letter from Vice President of Operations, Mark Lantz.....	2
Letter from John Doerr, Ph.D, PAS, Dipl. ACAN.....	3
4th Quarter 2021 State Averages.....	4-5
2021 State Averages.....	6-7
Mycophenolic Acid Graphs & Comparison Graphs.....	8-9
Guide for Mycotoxins in Dairy.....	10
Our Agrarian Solutions Team.....	11
About Agrarian Solutions Agrarian Advantage.....	12-13
Agrarian Solutions Products.....	14-15

Letter From Our President

It's certainly hard to believe how quickly the new year is upon us and most are moving full speed ahead. Agrarian Solutions is no different as we are actively working our plan to grow the business and better serve our customers. Supply chain and freight issues continue to challenge us, but we are determined to continue meeting the needs with world-class customer service. Our goal is to provide any assistance we can to help our customers be successful!

In this 4th Quarter Mycotoxin Report we hope to provide more valuable information to help you better manage your animals or provide better service to those who are feeding livestock. We realize that our mycotoxin test results are not getting turned around in an acceptable timeframe. We are working diligently to provide a better solution for this issue.

Please do not hesitate to contact anyone on our team. We are here to help and serve your needs. In fact, it is a pleasure to do just that. Wishing you the best for days and months ahead!



Mark Lantz
President
Agrarian Solutions®



Actlabs
41 Bittern Street,
Ancaster, ON, L9G 4V5

actlabs.com

Actlabs, in Ancaster, Ontario, Canada, is our partner in providing technologically advanced mycotoxin analyses. Actlabs is a global enterprise certified under ISO 9001 and 9002 specifications. They are credentialed under various Canadian agencies and are FDA approved. Analyses are done with high-performance liquid chromatography/tandem mass spectroscopy (LC-MS/MS). And no result is released until a trained technician carefully reviews each chromatogram for various parameters. This method gives excellent sensitivity and accuracy and permits determination of chemically related toxins within the sample. In each sample, 17 mycotoxins are analyzed and reports are optimized for best use by the client, including estimates of the degree of severity of the concentration(s) found.



Letter From Our Vice President of Science & Technology

It is my pleasure to welcome you to Agrarian Solutions first Mycotoxin Report of 2022. I urge you to spend a little time with it to see what's happening in your area, what the testing program can reveal, and how 4th quarter metrics may assist you in forecasting your needs for strategic planning for cow health and productivity this year. I have three main topics to address in this report.

1. The overall data should not come as too much of a surprise. This past summer many were expressing thanks that mycotoxin pressures seemed to be quite down from previous years. But if you look carefully at the comparisons for TMR and silage for the past three years, you'll find that while TMRs were slightly better in 2021, silage was intermediate between 2019 and 2020 on the basis of 4th quarter results. That, of course, reflects impact of new crop corn, and, certainly, that crop had its share of issues during the growing season. So, are you ready for the rest of this year? All four major mycotoxins are up in our silage vs. 2019. Be prepared.

2. You'll also see a bit of extra focus on mycophenolic acid (MPA). Those graphs speak for themselves, but is our experience in service testing consistent with what research groups find? In a review article¹ one group reported on testing 135 corn silage and 98 haylage samples in Germany. Incidence of MPA was 28% in the former and 37% in the latter with ranges of contamination from 20 - 35,000 ppb. Another group found 20-1,300 ppb in 42% of the 120 silage samples taken in PA. And a third team in Italy reported only an 8% incidence, but an average of 1,760 ppb and a max of 48,000 ppb in 196 samples tested there. For a toxin that still doesn't have fully characterized toxicology in dairy cows, these are not trivial data points.

But that's only showing it occurs. What does it do? Here's where it gets a little stickier. Except for human medicine, where MPA is a commonly used immune suppressant to prevent rejection of transplanted organs, little is known in domestic species, although a lot is suspected. The role in transplant protection involves an action against a particular enzyme plentiful in proliferating T- and B-cells. Thus, MPA is immune suppressive. That leads to suspicion of similar events in animals. Some work has been done, often showing little effect. But dogs died with high levels of MPA and, on low doses, showed anorexia, diarrhea, and enteritis². There are contradictory reports: a study with sheep showed no immuno-suppressive effects¹, but another showed a variety of *Penicillium* toxins (including MPA) caused up to 25% inhibition of macrophage activity in cattle¹. Therein lies the rub. Species of *Penicillium* that produce MPA, roquefortine C, patulin, and others, are tolerant of high CO₂ atmospheres

and low O₂ tension...read that as ensiled forages. The review¹ also reported on in vitro trials showing MPA had adverse effects on rumen microflora and gas and VFA production. The final quandary? We don't know yet what the interactive capacity of these mycotoxins might be. Apart from controlled research that may be a long time coming, dairy nutritionist and veterinarians could do a great service in sharing details, in a case-study fashion, of herds with high MPA tests. Another teaching point arises from the high test chart. Last January MPA tests were coming in well at low risk levels. But as the weather began to change, those values shot up and then receded as we moved into summer. Molds have particular triggers for secondary metabolite (mycotoxin) synthesis, but that process is accentuated as the swings between high and low temperatures increase; thus, Spring and Fall tend to be prominent times for mycotoxin explosions.

3. We introduced alternariol-methyl-ether, another relatively unknown mycotoxin in the livestock world, to our test panel last Fall. And we're waiting now for word that the lab has finished doing the standardization on patulin, yet another mycotoxin of interest. Soon, then, our complimentary testing program will be screening for nineteen mycotoxins and metabolites in your dairy rations. Further, to facilitate better cross-referencing of our test data, we released a new sample submission for last March and on January 1st, we began use of a new version of the analytical report we send to clients. With it comes our first estimates of risk for mycophenolic acid in dairy cows. And now comes my question. With a top-of-the-line independent lab doing the tests, with a steady progress in adding additional mycotoxins to the panel, and with the singular fact that our testing service is complimentary for our clients, why do we still have portions of the US that do not submit samples? If I were using mold counts or a local lab for testing, and paying out of pocket for that, I'd still be Johnny-on-the-spot to see what another lab might provide at no cost to me. Go figure! Agrarian stands ready to assist you with your herd health and reproductive issues; talk to us and let us work with you on a trial of our mycotoxin testing program.

Enjoy the report. Let us know if you have ideas for ways in which it can be improved to serve you better.



John Doerr, Ph.D., PAS, Dipl. ACAN.

Vice President, Science & Technology
Agrarian Solutions®

¹ Gallo, A., et al. (2015). Review on mycotoxin issues in ruminants: occurrence in forages, effect of mycotoxin ingestion on health status and animal performance and practical strategies to counteract their negative effects. *Toxins*. 7:3057-3111.

² Reviewed in Gruber-Dorniger, C., et al. (2017) Emerging mycotoxins: beyond traditionally determined food contaminants. *J. Agric. Food Chemistry*, 65: 7052-7070.



State	Zearalenone	DON Average	Fumonisin Average	T-2 Toxin Average	No. of Samples
AL	160	2450	1250	nd	3
AR	nd	490	400	nd	1
IL	99	1067	238	nd	9
IN	57	658	nd	1670	10
IA	140	668	667	nd	4
KS	nd	2000	4200	nd	3
MD	80	921	925	nd	8
MI	628	2700	333	5280	6
MN	186	460	330	190	42
MO	120	100	600	nd	2
NM	nd	490	750	nd	3
NY	1393	3806	180	nd	17
NC	245	1349	3967	60	17
ND	nd	260	nd	nd	1
OH	374	1855	760	nd	37
PA	440	2563	1066	nd	39
SD	40	223	100	80	6
VA	288	8543	1106	nd	18
WA	nd	nd	nd	nd	0
WI	270	1776	205	155	63

nd = none detected
 = low
 = medium
 = high

START DATE **October 1, 2021** | END DATE **December 31, 2021**

NO. OF SAMPLES 289



State	Zearalenone	DON Average	Fumonisin Average	T-2 Toxin Average	No. of Samples
AL	96	1096	745	nd	12
AR	nd	325	1900	nd	2
CO	nd	nd	nd	nd	6
GA	40	700	500	nd	2
ID	nd	1230	200	nd	2
IL	140	1276	420	475	17
IN	106	1111	418	1670	27
IA	256	723	325	155	25
KS	nd	760	2175	nd	6
MD	100	1643	600	nd	26
MI	222	987	275	707	45
MN	115	515	295	156	111
MO	120	151	1488	nd	8
NE	90	137	100	nd	4
NJ	195	2350	300	nd	2
NM	nd	490	750	nd	3
NY	835	2882	309	881	37
NC	216	1162	3681	80	37
ND	nd	260	nd	nd	1
OH	247	3178	549	274	154
PA	404	2418	927	206	175
SC	50	720	nd	nd	1
SD	93	384	100	80	21
TN	240	342	980	nd	5
TX	60	1400	250	120	2
UT	nd	240	100	nd	1
VA	260	3801	1534	268	69
WA	90	849	nd	60	9
WV	690	4793	700	nd	3
WI	204	1260	205	189	176

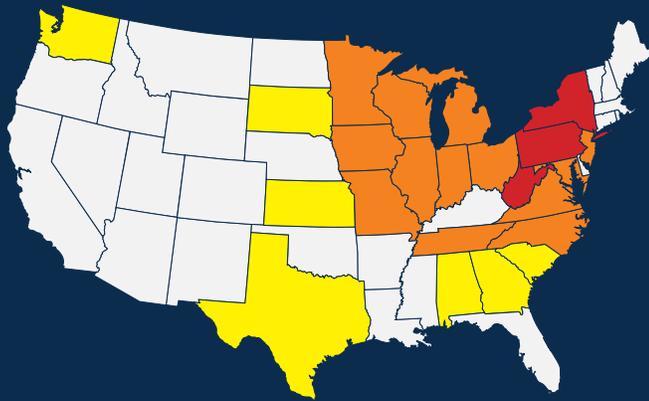
nd = none detected
 ■ = low
 ■ = medium
 ■ = high

START DATE **January 1, 2021** | END DATE **December 31, 2021**

NO. OF SAMPLES 989



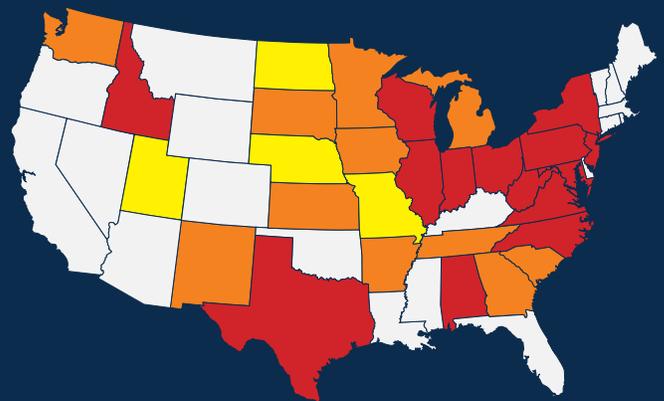
Zearalenone



ppb (parts per billion)

nd <100 100-300 301+

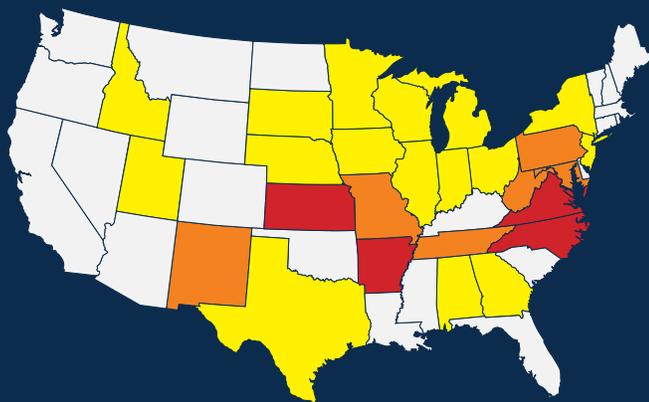
DON Average



ppb (parts per billion)

nd <300 300-1000 1001+

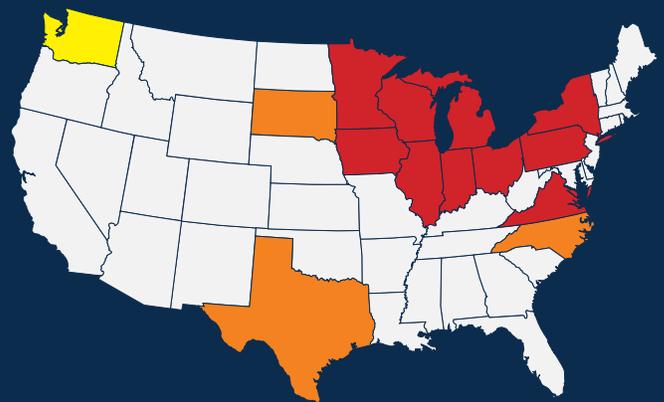
Fumonisin Average



ppb (parts per billion)

nd <600 600-1500 1501+

T-2 Toxin Average

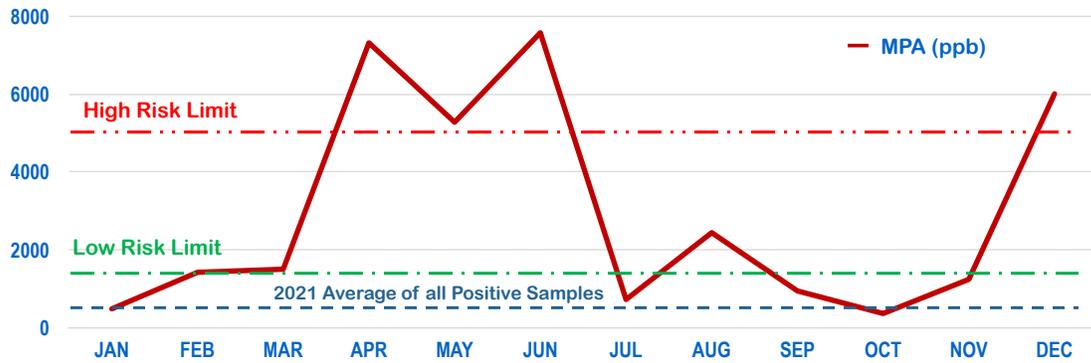


ppb (parts per billion)

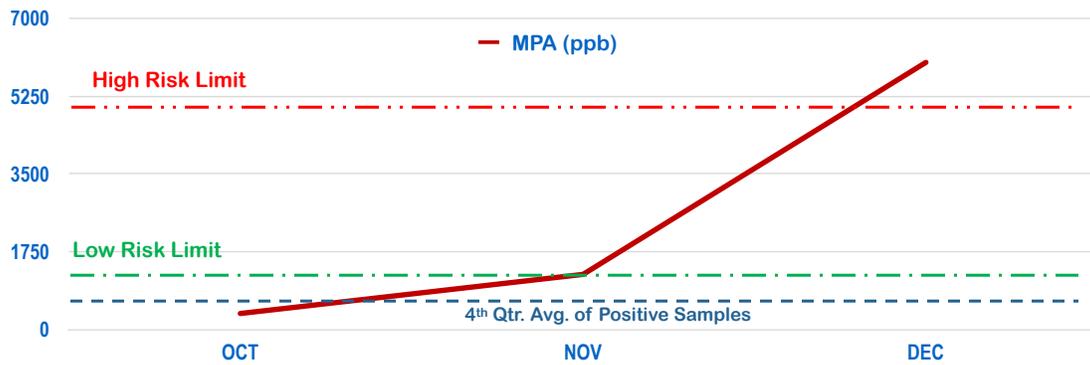
nd <75 75-150 151+



High Tests for Mycophenolic Acid – 2021

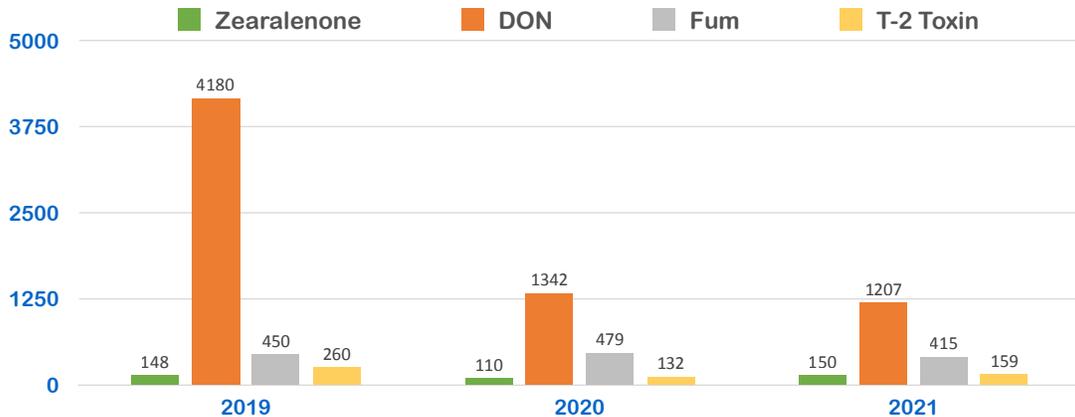


High Tests for Mycophenolic Acid – 4th Quarter 2021



4th Quarter Comparisons: TMR

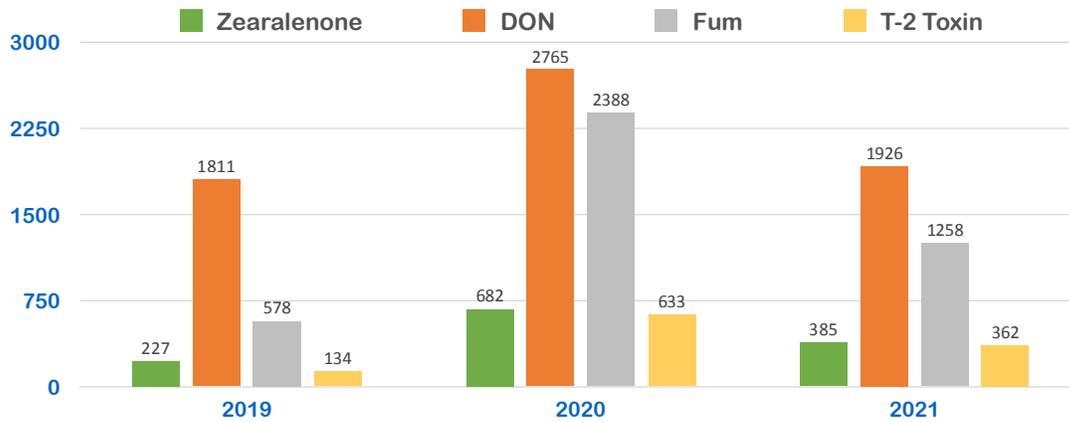
Average Mycotoxin (ppb)





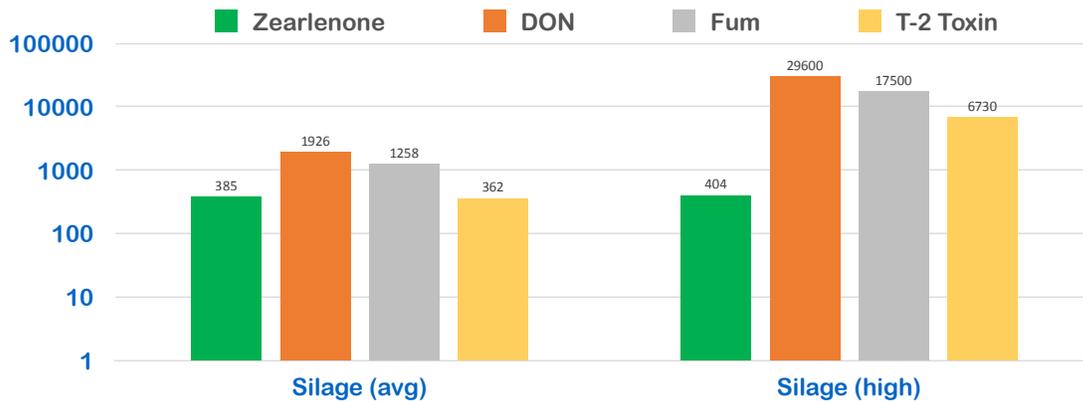
4th Quarter Comparisons: Silage

Average Mycotoxin (ppb)



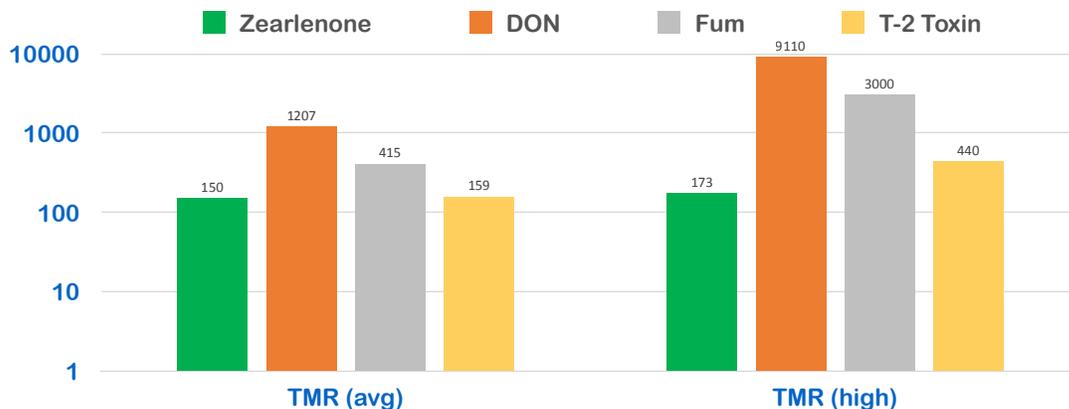
2021 Silage Tests

Average Mycotoxin (ppb, Log 10)



2021 TMR Tests

Average Mycotoxin (ppb, Log 10)





APPROXIMATE RANGE FOR RISK

MYCOTOXINS	LOW	MEDIUM	HIGH
DON (vomitoxin)	< 300 ppb	300-1,000 ppb	> 1,000 ppb
Zearalenone	< 100 ppb	100-300 ppb	> 300 ppb
Aflatoxin	< 10 ppb	10-30 ppb	> 30 ppb
T-2 toxin	< 75 ppb	75-150 ppb	> 150 ppb
Fumonisin	< 600 ppb	600-1,500 ppb	> 1,500 ppb
Mycophenolic Acid	< 1500 ppb	1,500-5,000 ppb	> 5,000 ppb

Revised 01/2022

Qualifiers

- Multiple mycotoxins will compound potential effects.
- Toxic effect may be increased by body condition, health challenges, or stress.
- Mycotoxins are not uniformly distributed in feedstuffs.
- Small samples yield high test errors and underestimate mycotoxin contamination rate.
- Low-level test results may still be cause for pro-active response.

Representative Symptoms

DON (vomitoxin)

Reduced feed intake / feed refusal

Reduced milk production; reduced milk fat

Poor reproductive performances

Elevated SCC

Impaired immune function

Loose, inconsistent manure

Zearalenone

Hyper-estrogenism

Poor reproductive performance

- Short cycle heats
- Cystic cows; follicular cysts
- Twinning cows; multiple ovulations
- Vaginitis
- Enlarged mammary glands in virgin heifers

Aflatoxin

Liver damage; altered protein synthesis

Decreased appetite/off feed

Lower milk protein

Impaired immune function

Increased disease rates

Highly interactive

Rough hair coat

T-2 toxin

Reduced feed intake

Intestinal hemorrhages

Frequent defecation

Bloody diarrhea

Absence of estrous

Impaired immune function

Increased disease rates

Fumonisin

Reduced feed intake

Reduced milk production

GI tract ulceration

Impaired immune function

Mycophenolic Acid (MPA)

Increased health events (immune suppression)

Lowered rumen efficiency

Loose manure

Lowered reproductive efficiency

Enteritis



Meet Our Agrarian Solutions® Team



MARK LANTZ



ROB HAMAKER



JOHN DOERR, PH.D.,
PAS, DPL. ACAP



CHAD CHRISTENSEN



DAN HOYING



NIC BRADLEY



SCOTT ZEHR



KURT MARQUARDT



KELBI VEENSTRA



LARRY ROTH, PH.D.,
PAS

We exist to help others succeed.



Agrarian[®]
SOLUTIONS





The Agrarian Advantage **Are You Making the Right Choice?**

Unique Technology

The Agrarian proprietary technology works within the intestinal cell wall to improve immune function, reduce the burden of pathogens, and combat feed-borne toxins that effect the performance and health of the animal.

State-Of-The-Art Testing Program

Agrarian Solutions is committed to offering mycotoxin testing at no charge as a service. Mycotoxins can wreak havoc on the dairy. We believe mycotoxin testing should be implemented on every dairy. Ask your local Agrarian Solutions representative how to take advantage of this special offer.

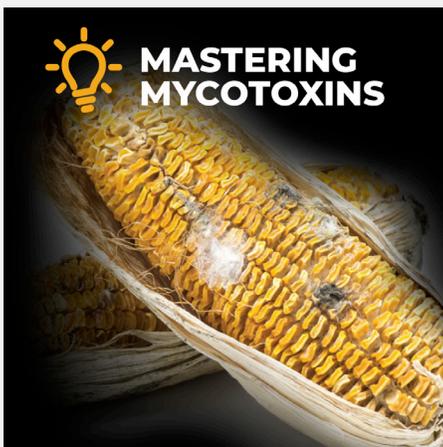
Professional Product Support System

Agrarian Solutions has a team ready to serve you. Our Agrarian Representatives are equipped to help provide outstanding product support. Whatever questions you may have we are here to help. Passion, Integrity, and Industry Expertise are all a part of what you will get from your local Agrarian Representative.

Customer's Economic Advantages

If your dairy is experiencing any environmental challenges it can have a huge impact on the overall herd health as well as the farms bottom line. Having sick cows, reproduction problems, and even death will ultimately place a big strain on the farm's bottom line. Our products will help prevent many of these common issues from happening, helping drive the dairies profits.

What Makes Agrarian Solutions Different



Mycotoxins and other challenging pathogens can severely impact animal productivity, increase incidence of disease due to immunosuppression, damage vital organs, and interfere with reproductive capacity.



The Agrarian proprietary technology works within the intestinal cell wall to improve immune function, reduce the burden of pathogens, and combat feed-borne toxins that effect the performance and health of the animal.



We believe everything is built on solid relationships. We work to help others succeed. We care about you, we are genuinely curious about you, and we want to find the best way(s) to help you in what you are doing. Let's win the day together!

A dark blue background featuring a microscopic view of various rod-shaped bacteria, some with flagella, creating a textured, organic pattern.

— OVER —
980
MYCOTOXIN
Tests Reported
— IN 2021

Agrarian Solutions has invested over **\$3 million** in **Mycotoxin Testing** since 2006.

Ask your Agrarian Solutions or Select Sires representative
about our **Free Mycotoxin Testing**.



Superior Protection for Your Genetic Investment

CONVERT CALF CARE PRODUCTS



CONVERT™ Powder

For optimal calf health and performance

- **Key Ingredients** | Blend of naturally occurring direct-fed microorganisms, L-form *Lactobacillus*, microbial sugars, enzymes and specialized proteins
- **Focus** | Healthy Calves
- **Feeding Rate** | Up to four scoops at birth and then one dose per day for 20 days added to milk or milk replacer



CONVERT™ Gel or Bolus

Protect your herd's future; don't let your calf have a bad day

- **Key Ingredients** | The same important ingredients as Convert powder in an extremely concentrated form
- **Focus** | Newborns and individual calves faced with environmental challenges
- **Feeding Rate** | Five to 15 cc of gel or one bolus (can be used instead of Convert™ Powder at birth and then use Powder for 20 days)

DIRECT FED MICROBIALS



Select BioCycle®

Healthy cows 24/7

- **Key Ingredients** | Two strains of L-form *Lactobacillus*, two sources of yeast, four digestive enzymes, microbial sugars and specialized proteins
- **Focus** | Excellent direct-fed microbial, aides in modulating immune function, digestion, and combats environmental challenges
- **Feeding Rate** | 1/2 ounce per head per day to animals not exposed to mycotoxins



Select DTX™

Broad-spectrum, multiple benefits

- **Key Ingredients** | Specific L-form *Lactobacillus*
- **Focus** | Proven to be effective in neutralizing the damaging effects of mycotoxins. Fed to lactating cows, dry cows, and heifers
- **Feeding Rate** | 1/2 ounce per head per day. When mycotoxin levels are extreme, use DTX in addition to a single dose of BioCycle Plus™ to the milking herd



Select BioCycle® Plus

The Gold Standard to healthy herds

- **Key Ingredients** | The best of both BioCycle™ and DTX™
- **Focus** | Lactating dairy cows exposed to mycotoxins. When mycotoxin levels are extreme, the addition of DTX™ is recommended
- **Feeding Rate** | 1/2 ounce per head per day



CONCENTRATES



Select BioCycle® Concentrate

Stronger heats and overall animal health

- **Key Ingredients** | Two types of L-form *Lactobacillus*, two sources of yeast, four digestive enzymes, microbial sugars and specialized proteins
- **Focus** | Recommended when performance improvements are needed in reproduction, and overall herd health
- **Feeding Rate** | Mix into dairy feeds at a rate of five grams (5g) per head per day



Select BioCycle® Plus Concentrate

A complete approach to feed and herd performance challenges

- **Key Ingredients** | The best of both BioCycle and DTX
- **Focus** | Lactating dairy cows exposed to mold produced challenges
- **Feeding Rate** | Mix BioCycle Plus Concentrate into dairy feeds at a rate of 10 grams per head per day



Select DTX™ Concentrate

Combats environmental and feed related challenges

- **Key Ingredients** | One specific L-form *Lactobacillus*
- **Focus** | Designed specifically for feed challenges caused by molds and their metabolites
- **Feeding Rate** | 9 grams (0.02 lbs.) per head per day

FRESH COW SOLUTIONS



BioFresh® Bolus

Dairy producer's choice for times of stress

- **Key Ingredients** | 8x dose of BioCycle with added vitamins and minerals
- **Focus** | Assists Somatic Cell Count (SCC) by modulating the immune functions of cows affected with environmental mastitis challenges. The direct-fed microbial action gets fresh cows on feed faster, reducing potential metabolic disorders and Displaced Abomasums (DA's)
- **Feeding Rate** | One bolus per day for three days at freshening



PROVEN PERFORMANCE

Thousands of dairy and beef producers have seen the results from this family of direct-fed microbial products and report:

- Stronger heats
- Lower somatic cell counts
- Higher fat tests
- Better feed utilization
- Less metabolic problems
- Healthier Calves
- Improved reproductive performance
- Fresh cows off to a better start



Notes

GLOBAL SOLUTIONS FOCUSED ON
Livestock Health & Performance



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