Escent®

Essential multi-task protection, support and prevention

(Escent® is not available in the USA and Canada)

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Escent®: Mode of Action

Escent®

Essential multi-task protection and support.

Each mycotoxin has different physical and chemical structures and feedstuffs are naturally contaminated with various toxins. Therefore, functional mycotoxin control requires various modes of action.

Escent® is a blend of different active ingredients that ensures a multifactorial approach for protection and support in 5 different ways:

Reduction of immunosuppression

A reduced status of the immune-system is alleviated by the use of Beta-glucans and well selected plant extracts.

Reduction of oxidative stress

The presence of mycotoxins plays an important role in lipid peroxidation at cell level. *(see fig. 1)*
Both synthetic and natural antioxidants avoid further action of free radicals towards the intestinal microflora, tissues and cells, protecting the natural pathways of biotransformation of mycotoxins.

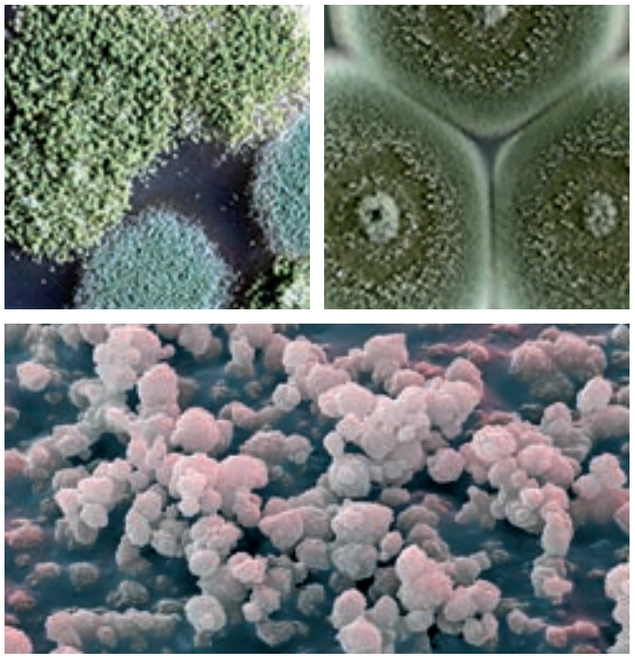
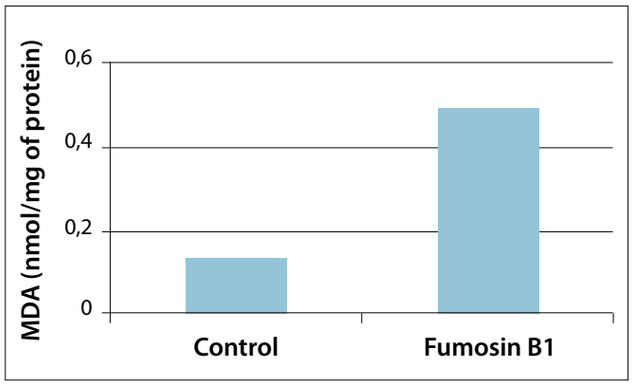


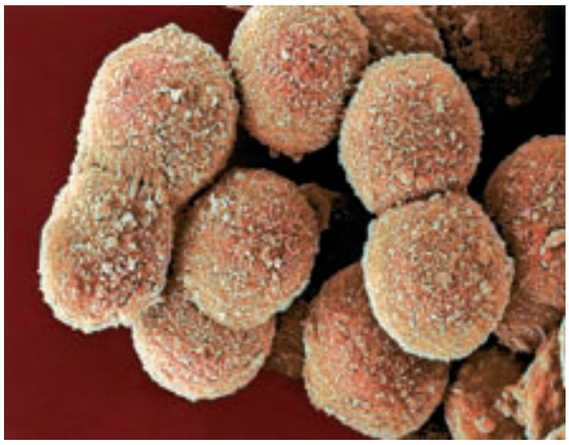
Fig. 1: Oxidative activity of Fumonisin B1 on kidney cells (Abado-Becognee K et al., 1998)





Organ support

The liver and kidneys are crucial organs in the detoxification and elimination process of toxic principles in the blood. Several mycotoxins have a well-known impact on the functioning of these organs.
Escent® contains various plant extracts, selected for their ability to maintain and restore organ function in case of toxic stressors.



Mycotoxin adsorption

Both high adsorbent mineral clays and yeast extracts rich in gluco-mannans are used to adsorb mycotoxins.
Their role is to adsorb mycotoxins efficiently, selectively and quickly, reducing the bio-availability for the organism.

Mold inhibition

In order to eliminate further mold development, and by consequence potential mycotoxin production, a selected mold inhibitor makes **Escent®** a well-balanced mixture between support, protection and prevention.

Mycotoxins inactivator evaluations & study. The assessment of the effectiveness of Escent® S on dairy cows fed artificially contaminated feed

Date & Location: Quarter 3 2012, Federal Government Institution – Federal Center for Toxicological, Radiation and Biological Safety – Russia **Species:** Dairy cows

Evaluation:

- 3 treatments of 10 cows each for a period of 15 days
- Artificial contamination:
  – 250 ppb of Zearalenone
  – 200 ppb of T2-Toxin
- **Escent® S** dosed at 30 g/h/d

The test performed at the Federal Center for Toxicology was very challenging as we put to test Escent® against the most difficult toxins in lactating dairy cows; DON, T-2 and Zearalenone in synergism.

T-2 and DON belong to the trichothecenes group and have a broad spectrum harmful effects on various body organs, systems and cell structures starting with gastrointestinal issues like leaky gut, vomiting, dermonecrotic caustic ending, cell membranes peroxidation, impact on immunity, glucose, protein and mineral metabolism.

Based on the low milk production, the level of glucose and LDG in the blood, this herd was most probably suffering from ketosis from the beginning of the experiment prior to the addition of artificial mycotoxin contamination.

Blood serum:

Parameter	Group						Physiological norm
	1(Control)		2 (Toxins)		3(Toxins + ESCENT)		
	Before the experiment	At the end of the experiment	Before the experiment	At the end of the experiment	Before the experiment	At the end of the experiment	
Whole protein, g/l	86,0±1,4	86,8±0,7	85,0±2,2	76,0±1,6**	84,0±1,4	83,6±1,2	83-86
amylopsin, U/l	55,8±0,4	52,6±0,5	50,1±0,6	58,6±0,7**	58,0±1,4	52,4±0,9*	до 60
Alkaline phosphatase, U/l	86,0±2,0	85,0±1,3	87,0±1,6	70,0±1,5***	81,0±0,6	80,0±0,6	до 100
ALT, U/l	54,0±1,3	51,3±0,7	48,8±0,5	53,0±0,7	48,8±0,4	49,5±1,0	до 55
AST, U/l	84,0±2,5	83,1±2,8	88,5±0,4	91,7±1,7	83,0±1,6	71,0±0,8***	70-100
GGT, U/l	8,5±0,2	8,5±0,2	8,2±0,3	8,5±0,4	8,4±0,1	8,5±0,1	7-10
LDG, U/l	860,0±9,3	814,5±4,3	872,0±2,7	622,0±2,9***	694,0±6,6	761,0±6,6***	до 1000

The T-2 toxin is known to inhibit protein synthesis. Whole protein measurements (albumin produced by the liver) & globulin (made by the liver and the immune system) can give an indication of the liver and immune system status. Animals in the contaminated group indicated compromised liver and immune systems as their whole protein blood levels decreased significantly from 85.0 g/l down to 76.0 g/l. With the animals that were fed Escent®, the whole protein blood levels remained constant at 84.0 g/l. This clearly indicates a detrimental effect mainly from T2-toxin and a protective effect provided by Escent®.

Alkaline phosphatase (ALP) is produced by the muscles, liver and bones. Generally speaking abnormal levels of ALP in blood most often indicate a problem with the liver and/or bones. However, it can also indicate malnutrition. The drop in ALT indicates a possible failure of the liver.

Looking at AST, an enzyme produced by the liver, we can conclude that in the presence of toxins contamination levels have gone up to 91.7 U/l, which indicates a higher amount to be found in the blood rather than in the liver where it belongs and needs to function. The Escent® treatment kept the level down to 71.0 U/l, suggesting a better functioning liver.

Results:

No clinical signs of intoxication were detected. Feed and water consumption were the same. The obtained results evidenced the expressed **negative effect of mycotoxins on dairy cows' liver function**. Using **Escent® S** allows us to decrease the toxins effect by its removal from the gastro-enteric system.

Milk Production:

Experiment day	Group		
	Control	Toxins	Toxins + ESCENT S
Average value during the whole experiment	20,06	19,14	19,8
Production rate during the experiment	301,0	287,1	297,8
		-4,6% versus control	+3,7% versus Toxins fed group

Escent® S provides an increase in milk production thanks to its ability to reduce mycotoxins adsorption and to inhibit the endogenous toxic aggregates.

This research confirmed that using the **Escent® S** mycotoxin inactivator in lactating cow diets contaminated with mycotoxins offers a protective effect against toxins and promotes animal welfare.

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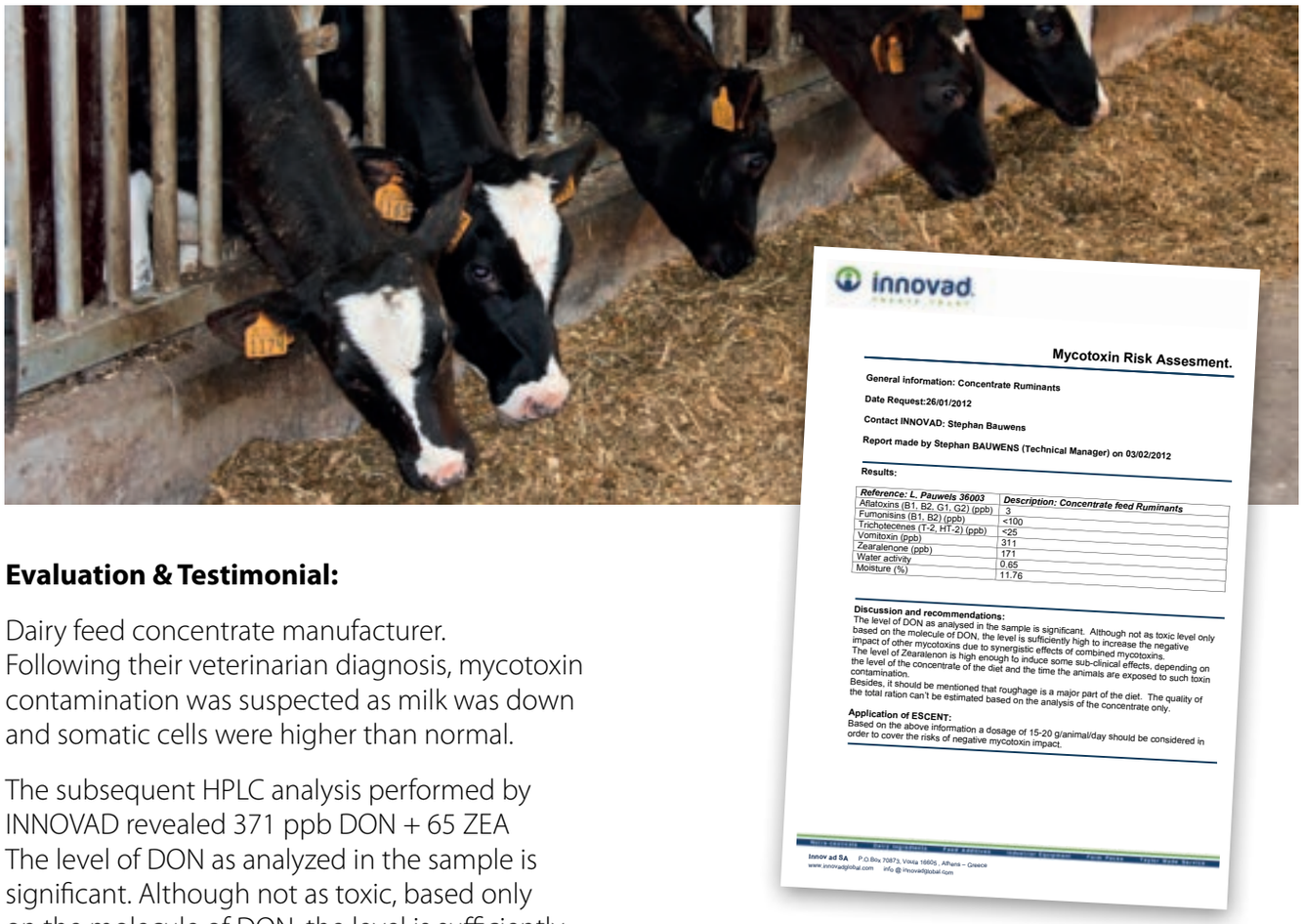
Dairy Evaluation & Testimonials – DON & Zearalenone

Date & Location: January 2012, Belgium **Species:** Dairy Cows



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Mycotoxin Risk Assesment.

General information: Concentrate Ruminants

Date Request:26/01/2012

Contact INNOVAD: Stephan Bauwens

Report made by Stephan BAUWENS (Technical Manager) on 03/02/2012

Results:

Reference: L. Pauwels 36003	*Description: Concentrate feed Ruminants*
Aflatoxins (B1, B2, G1, G2) (ppb)	3
Fumonisins (B1, B2) (ppb)	<100
Trichotecenes (T-2, HT-2) (ppb)	<25
Vomitoxin (ppb)	311
Zearalenone (ppb)	171
Water activity	0.65
Moisture (%)	11.76

Discussion and recommendations:
The level of DON as analysed in the sample is significant. Although not as toxic level only based on the molecule of DON, the level is sufficiently high to increase the negative impact of other mycotoxins due to synergistic effects of combined mycotoxins.
The level of Zearalenon is high enough to induce some sub-clinical effects, depending on the level of the concentrate of the diet and the time the animals are exposed to such toxin contamination.
Besides, it should be mentioned that roughage is a major part of the diet. The quality of the total ration can't be estimated based on the analysis of the concentrate only.

Application of ESCENT:
Based on the above information a dosage of 15-20 g/animal/day should be considered in order to cover the risks of negative mycotoxin impact.

Innov ad SA P.O.Box 70873, Vivlia 16605 , Athens – Greece
www.innovadglobal.com info @ innovadglobal.com

Evaluation & Testimonial:

Dairy feed concentrate manufacturer.
Following their veterinarian diagnosis, mycotoxin contamination was suspected as milk was down and somatic cells were higher than normal.

The subsequent HPLC analysis performed by INNOVAD revealed 371 ppb DON + 65 ZEA
The level of DON as analyzed in the sample is significant. Although not as toxic, based only on the molecule of DON, the level is sufficiently high to increase the negative impact of other mycotoxins due to the synergistic effects of combined mycotoxins.

The level of Zearalenone is high enough to induce some sub-clinical effects, depending on the level of the concentrate of the diet and the length of time the animals are exposed to such toxin contamination.

It is also worth mentioning that roughage is a major part of the diet. The quality of the total ration cannot be estimated based on the analysis of the concentrate only.

Application of Escent®:

Based on the above information a dosage of 15-20 g/animal/day should be considered in order to cover the risks of negative mycotoxin impact.

Results (Milk production):

**Producer satisfied (milk production improved and somatic cell counts down).
Re-ordering ever since**

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Dairy Evaluation

Date & Location: Q1-Q2 2015 , Milano, Italy

Species: Holstein Dairy cows

Experiment:

- University of Milano
- 200 cows – TMR fed
- 2 treatments
- 30 days before calving till 150 after calving
- Natural contamination (Afla , Zea, DON)
- Avg Milk production 36 kg/c (+/- 11 000 kg /c/y)
- **Escent® S** at 35 g/h/d

Results:

- Red blood cells (KRL) : 10% improvement
- NEFA in the liver : Trend to have less with Escent®
- Lower body loss
- ALP reading better
- Ovarian cyst reduced
- Cows in second lactation : +3,8kg milk*
- Cows in third lactation : + 5,2 kg milk*

** Raw milk*

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Technical Bulletin

TOXINS, the hidden menace in feed & silage and their consequences on dairy performance, oxidative stress and liver function

The risk

There is a good chance that molds and toxins have crept into silos around the country again this year. The key today is to be aware that there is a potential problem with toxins. It might still be too early to tell how serious the challenge might be, but it is important that producers are prepared and take preventive measures. From past sampling multiple mycotoxigenic molds, including Aspergillus, Fusarium, Penicillium were found in corn silage samples at harvest and after ensiling. This suggests the possible presence of **multiple mycotoxins**.

The worst thing that can happen is for the producer to get into a position where he has to **react to a bad situation. By then, dry matter intake is down, the farm has lost a few weeks of milk, and many costly ingredients have gone to waste**.

The following symptoms could be associated with multiple mycotoxins contamination & feed related stress:

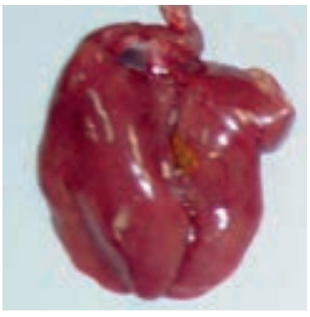
- Below normal milk production
- Oxidative stress
- Increased incidence of disease (opportunistic)
- Reduced production efficacy
- Poor reproductive performance
- Little or no response to veterinary therapy
- Difficulty of diagnosis & masked toxins
- Pale enlarged fatty liver
- Inconsistent dry matter intake

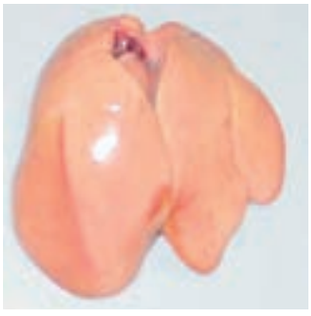
Detoxification & the role of the liver & rumen

While the rumen microorganisms can do something to degrade a certain degree of toxins, rumen metabolites of such mycotoxins may be equally or more toxic.

Such activity is lower in case of rumen dysfunction or when the animal's immune system is depressed (i.e. early lactation). It is the cow's liver that is affected and needs to convert the toxins into something benign that can be excreted. Hepatic bioconversions of mycotoxins will need to take place – **risking liver overload** – to change the polarity. **The cow's liver may not be able to detoxify all those components**.

Mycotoxins decrease the function of organs such as the liver and kidneys. Mycotoxins are not the only toxic material that the animal has to cope with. The liver, the main detoxification organ, needs to clear and detoxify not only mycotoxins present in the feed , but also enterotoxins (toxins produced by bacteria – that are usually not checked for) and many other contaminants.
Therefore, products that stimulate organ function can reduce the negative impact of the toxins. Various plant extracts, present in **Escent®** Dairy Pack, have been known to maintain and restore organ function in case of toxic stressors.


normal liver


compromised liver

Oxidative stress

Considering that mycotoxins are among the stress factors that have a negative effect on pro & antioxidant balance in the body and especially in the cells, free radicals can get out of balance. This may lead to a situation in which **the cow is no longer able to quickly detoxify these products, leading to oxidative stress**.
An animal 's oxidative balance is one of the many factors that can limit milk production. Dealing with oxidative stress requires more energy from the animal that could otherwise be used for milk production, growth, longevity, fertility and overall animal productivity.
There is a natural balance between free radical formation and the defense system. For the dairy cow to stay healthy, the system should stay in balance. When the system is out of balance, the body initiates an oxidative chain reaction, resulting in oxidative stress. Peroxides damage can occur in lipids, which can cause free radical formation. Those changes at cellular level can modify metabolic pathways, leading to decreased efficiency and premature cell deaths.
Once critical structural damage occurs, antioxidants may no longer be able to repair problems. When free radical production is greater than the ability of the animal to quickly detoxify these products, oxidative stress occurs.

How we can help?

Part of the answer is to build dietary strategies to enhance liver function (as well as kidney function) and to aid in reducing intestinal absorption of toxins and their related oxidative stress.

Adding one to two ounces per head per day of **Escent® Dairy Pack** will help. This solution is indicated especially when feed quality and intake is not what it should be. "More milk is the result of keeping the rumen healthy and the cow functioning normally".

We **emphasize the need to be proactive** when dealing with mycotoxins and molds. Keep an eye on feed intake. Check the silo regularly. This is one problem that is more easily prevented than remedied.

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Published Article

Toxic contamination effect on rumen and liver function.

Stephan BAUWENS – Technical Director INNOVAD SA/NV (Belgium)
John VERMEULEN – Product Manager Ruminants INNOVAD SA/NV (Belgium)

Molds are filamentous fungi that occur in many feedstuffs including roughages and concentrates. Molds produce poisonous substances, called mycotoxins, affecting the animals' health and productivity. This disorder is known as mycotoxicosis.

Mycotoxins are produced by a wide range of different molds and are classified as secondary metabolites, meaning that their function is not essential to the mold's existence. Mycotoxins can be formed on crops in the field, during harvest, or during storage, processing, or feeding. Molds are present throughout the environment. Their spores are present in high concentrations in the soil and in plant debris, and lie ready to infect growing plants in the fields. Field infestation is characterized by yield loss, quality loss and mycotoxin contamination. Mold growth and production of mycotoxins are usually associated with extreme weather conditions, poor storage practices, low feedstuff quality, and inadequate feeding conditions. Because feedstuffs can be contaminated pre-harvest, control of additional mold growth and mycotoxin formation are dependent on storage management. After harvest, temperature, water activity, and insect activity are the major factors influencing mycotoxin contamination of feedstuffs.

It is generally accepted that the Aspergillus, Fusarium and Penicillium molds are among the most important mycotoxins producing molds that are detrimental to cattle.

The potential risk for mycotoxins is mostly well understood for cereals like corn, wheat and barley, but the situation is largely different when we

consider roughages for ruminants, although these feedstuffs often represent the most important part of the diet. Potential reasons for the unknown risk are multiple. Silages are less frequently traded; they are more heterogeneous and present sampling and analytical challenges. An understanding of possible risks, for this part of the diet in particular, is important in realizing consistent production, protecting animal health and well-being and improving farm economics.

Fusarium infections are more commonly associated with warm conditions at silking, insect damage and wet conditions late in the growing season. It has been found on fresh harvest corn, but no viable spores could be found in the silage. Although Fusarium apparently does not develop inside the silage, Zearalenone, Fumonisins and Deoxynivalenol belong to the most common toxins in ensiled roughages.

The individual Penicillium species have variable requirements for temperature and moisture but are more likely to grow under post-harvest conditions, in cooler climates, in wet conditions, at a lower pH and some require little oxygen. Penicillium molds produce ochratoxin and silage derived mycotoxins such as Roquefortine C. Several Penicillium species could be detected in fresh corn, while several of these have been analyzed at a higher frequency in ensiled material, indicating Penicillium develops inside the silo. Roquefortine C is frequently detected in ensiled corn, adding to the list of most common mycotoxins in silages. The silage derived mycotoxins have an antibiotic effect on rumen microbes, reducing their detoxification capacity. Several other mycotoxins such as the ergots and patulin are known to affect cattle and may be

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prevalent at times in certain feedstuffs and silages.

Aspergillus species normally grow in lower water activities and at higher temperatures than the Fusarium species. Therefore, Aspergillus flavus and its related toxin (aflatoxin) in corn are favored by the heat and drought stress associated with warmer climates.

Ruminants are generally considered to be less susceptible to the adverse effects caused by mycotoxins. For animals with a completely developed forestomach-system, the rumen fluid content is, for certain mycotoxins such as ochratoxin A, zearalenone, T-2 toxin, diacetoxyscirpenol and deoxynivalenol, a detoxifying barrier with protozoa being significantly more active than bacteria. For this reason, the rumen has long been considered a very strong buffer against a possible negative impact of the mold's toxic metabolites. However, other aspects should be taken into account before disregarding mycotoxins' hazardous effects in ruminants.

Not all toxins are degraded or transformed. Aflatoxin, most known for its transition as Aflatoxin M1 in milk, is hardly transformed and passes the rumen for approximately 90%. The other way around, transformation of mycotoxins in the rumen environment is not always equivalent to reduced toxicity. 90% of Zearalenone (ZEN) can be converted to α-Zearalenol, which is ten times more toxic than its parent toxin itself.

It should always be considered that mycotoxins will adversely impact rumen environment and activity even before having an effect on the animals themselves. Decreases in ruminal motility, on DM, ADF and starch digestion and on microbial growth are some of the impacts seen in animals fed mycotoxin contaminated diets, directly impacting production and indirectly initiating other metabolic disorders. Additionally, toxins like Aflatoxin and Deoxynivalenol reduce feed intake and by consequence further nutrient supply.

In dairy cattle, T2-toxin has been associated with intestinal hemorrhages, bloody faeces, gastrointestinal lesions and enteritis, and finally disrupting the digestive process in the lower part of the digestive tract.

Reproduction and fertility, cornerstones of modern dairy farms' economics, can be compromised significantly by the presence of ZEN. Swollen vulvas, vaginal or rectal prolapse can be observed as well as lower conception rates, mastitis or abortions.

Crucial organs, such as the liver, are stressed and damaged by the aggressiveness of the mycotoxins (Aflatoxin and Fumonisin) after absorption, while immune function is compromized by most of the already mentioned toxins. Both, the liver and the immune cells, have a very high metabolic activity which makes them extra vulnerable for oxidative stress by aggressive molecules such as these. Oxidative stress is an imbalanced ratio between free radicals (endogenously or exogenously produced) and the natural existing antioxidant system for free radical neutralization. Considering that mycotoxins are among the most important exogenous stress factors that might create increased oxidation rates in tissues and cell structures, it has to be considered that important organs such as blood, liver, kidneys, etc. might get affected by the aggressiveness of these molecules, which results in impaired functionality.

Another aspect worthwhile mentioning is the higher incidence of lameness on dairy farms contaminated with mycotoxins. Lameness alone in dairy farms already causes large financial losses due to a decreased milk production, impaired reproductive performance and higher culling and veterinary costs. In a study conducted in 2005 by Özsoy S, et al., a positive relationship was established between aflatoxin contamination of feed, lameness (subclinical laminitis) and impaired fertility (cystic ovaries).

The toxins of major concern for dairy cows are Aflatoxin, Deoxynivalenol, Zearalenone, T2-toxin, Fumonisin and PR-toxin. Their negative impact is amplified by a negative energy balance and/or a highly productive stress, but most of the time starts unnoticed. Within days or weeks, the effect of continued mycotoxin ingestion on performance becomes more pronounced; although symptoms remain very variable and mycotoxin induced diseases seldom respond if at all to veterinary therapy.

Feeding animals with mycotoxin contaminated feed causes a range of problems starting from feed intake to impaired milk production, reduced reproduction, lower immunity and health status. All together, they might be responsible for significant economic losses, by some estimated at billions of dollars.

Research and practical experience have proven that there is no single method for effective mycotoxin control, but many agree that mycotoxin management in the diet is a valid insurance policy. The best way to counteract problems related to mycotoxins might lay in the combination of actives, partially focusing on direct mycotoxin absorption and/or transformation, while ensuring metabolic support at the same time. Metabolic support should put emphasis on maintenance and balancing the rumen micro flora, oxidative stress management, essential organ support and immune stimulation. ■

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Published Article

Finding the dietary solution to toxins, stress and immunity in dairy cows.

Dr Rüdiger Kratz – Technical Services – Ruminant. INNOVAD SA/NV (Belgium)

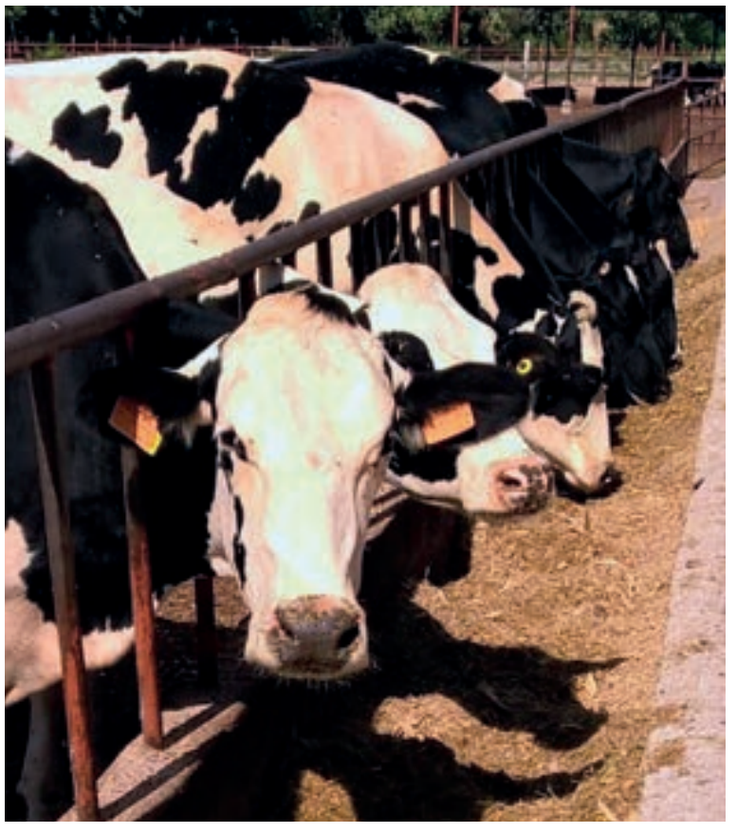
The entire dairy industry, including consulting nutritionists, veterinarians and producers, all strive to keep their herd in good health knowing that healthy cows will be able to cope better with stress, especially with potentially contaminated feedstuffs.

Stress resulting in oxidative stress can negatively impact the dairy cow. Molds and mycotoxins, endotoxins, hidden toxins in the feed, extra heat, pathogens challenges, environmental issues, changes in diets, transition period and calving all compromize the cow's immunity system and its ability to deal with possible diseases, causing immune suppression. As a result, higher somatic cell counts, lower milk yield, poorer reproduction performance, mastitis and metritis, are observed.

Molds are omnipresent. Their main task in nature is to decompose organic matter. More than 400 mycotoxins have been identified but about 20-30 are frequently detected with highly sensitive analytical methods (LC/MS-MS) in feed and food in higher concentrations. The most critical mycotoxins for ruminants are deoxynivalenol (DON), zearalenone formed by Fusarium spp. and aflatoxin B by Aspergillus.

Fumonisins, ochratoxin A, ergot alkaloids as well as silage-associated roquefortin C and mycophenolic acid can also be detected.

The formation of mycotoxins undergoes significant regional and seasonal variation and among other things depends on the nutrient supply, water content in the substrate and in the surrounding air, temperature and pH. The optimum conditions for mold growth and toxin formation do not necessarily need to coincide.



Molds and mycotoxins in feed cause chronic, 'subacute' problems in dairy cattle that show up with signs of higher disease incidence, reduced fertility or sub-optimal milk production.

This is mediated by the following modes of action:

- Reduced intake or feed refusal.
- Altered microbial growth in the rumen.
- Reduced nutrient absorption and impaired metabolism.
- Altered endocrine and exocrine systems.
- Suppressed immune function.

Experience from research and practice indicates that individual actions are not sufficient.
The best way to eliminate such risks related to the concurrent presence of toxic contaminants along with all other stresses inherent to the cows' production challenges seems to lay in a combination of actions – the cow's metabolic support emphasizing maintenance and balancing oxidative stress management, the essential organ (liver mainly) aid, the stimulation of rumen function and immune response, along with the reduction of mycotoxins adsorption and toxins toxicity through their bio-transformation.

Balancing oxidative stress

In biological organisms, such as the dairy cow, the antioxidant system and pro-oxidative substances (reactive oxygen species (ROS) are finely regulated at cellular level. Many studies have shown oxidative stress as a fundamental factor of unwanted immune and inflammatory responses.

Dairy cows, especially in the phase from gestation to lactation, are susceptible to a variety of diseases. ROS affect the regulation of gene expression, and the antimicrobial activity of the macrophages. Elevated levels of ROS damage nucleic acids, proteins and lipids, affecting important physiological functions. Food spoilage and mycotoxins are considered oxidative stress triggers. It is not yet completely clear whether this is done by direct stimulation of the formation of ROS or indirectly by weakening the antioxidant system. Presumably, both paths are taken.

In most cases, the levels of natural antioxidants are reduced due to lipid peroxidation caused by mycotoxins.

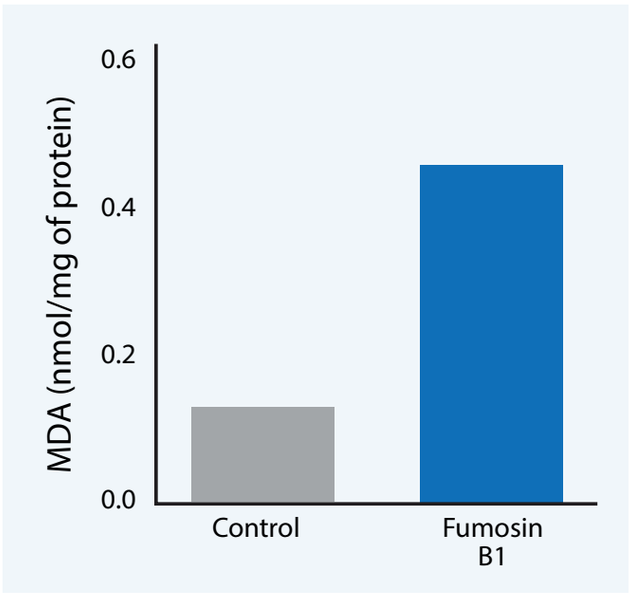


Figure 1. Oxidative activity of Fumonisin B1 on kidney cells (Abado-Becognee et al 1998).

Fumonisin B1 was found to be a strong inducer of malondialdehyde ***(marker of oxidative stress, see Fig. 1)***

The antioxidant system of the mammalian cell is complex and consists of proteins, enzymes, vitamins and pro-vitamins, which are found in the cytosol, mitochondria or cell membrane.

Special secondary plant metabolites such as the polyphenols can stabilize the existing system. Polyphenols are a complex group of substances, which can be divided into phenolic acids and flavonoids and being subdivided much further. They play an important role in

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building the cell walls that protect the plant from harmful influences such as UV light and pathogens and are involved in the repair of cellular damage.

The absorption of the polyphenols occurs mainly in the small intestine ***(Fig. 2)***. They may be chemically modified, bound on albumin to become water soluble and reaching the liver via the portal vein. In the liver, other molecular changes take place, such as hydroxylation, decarboxylation and conjugation, having the polyphenols become hydrophilic and excreted via the kidneys in the urine.

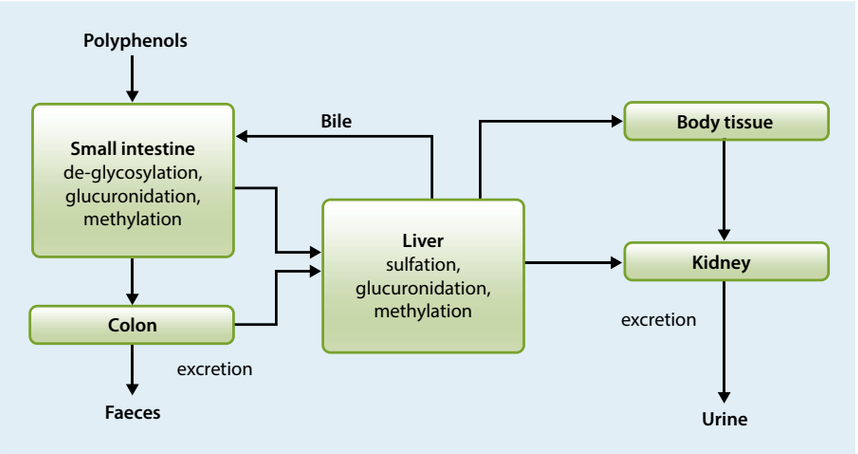


Fig. 2. Metabolism of polyphenols.

Thus, the main sites of action for polyphenols are the intestinal mucosa, liver, and kidneys. The structural variability of polyphenols is also reflected in their effect. For example proanthocyans are very poorly absorbed and their effect remains limited on the intestinal mucosal area.

Flavanones and isoflavones show the best bioavailability and can exert their antioxidant potential in blood, liver and kidneys. However, the concentrations fall quickly after stopping supply, so that constant feeding is necessary. The antioxidant potential of polyphenols can be measured in relation to vitamin E in Trolox equivalent antioxidant capacity (TEAC), showing a broad variation of <0.1 to >5.0 mM TEAC per mM polyphenol. Therefore the usage of polyphenols presupposes their effectiveness in terms of absorption and antioxidant capacity.

Supporting liver function

Crucial organs, such as the liver, are stressed and damaged or malfunctioning due to the presence of mycotoxins (aflatoxin and fumonisin) after absorption, while immune function is compromized by most of the other mentioned toxins.

The liver has a very high metabolic activity that makes it extra vulnerable for oxidative stress by aggressive molecules. In addition, the liver of dairy cows during early lactation is exposed to specific extra stresses. Low concentrations of glucose and insulin in the blood and increased influx of free fatty acids lead to fat deposition in the liver. Molds and mycotoxins can exacerbate this further by reducing feed intake. Some herbal ingredients have been proven to protect the liver. Experience with various parts of plants or extracts are supported by trials with cell cultures (in vitro model), animal studies (in vivo model) and clinical trials in humans.

Rosmary is well known for its strengthening effect on liver functions. Production and flow of bile are stimulated, so that the digestion is improved. The glucuronidation of unwanted molecules is increased, leading to accelerated elimination via urine and diminishing their potential disease impact. Artichoke leaves are a liver detoxifying and regenerating agent. It is mainly used to treat liver dyspepsia and disease. Main active components are cynarine and other bitter substances resulting in the regulation of lipid digestion.

Stimulating rumen function

It should always be considered that mycotoxins will adversely impact the rumen environment and activity even before having an effect on the animals themselves. Decreases in ruminal motility, on dry matter intake, acid detergent fibre (ADF), starch digestion and microbial growth are some of the

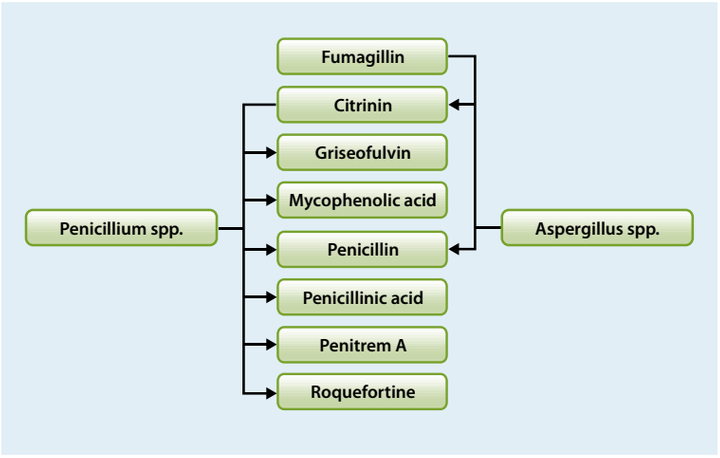


Fig. 3. Antibiotics produced by Penicillium and Aspergillus spp.

issues seen in animals fed mycotoxin contaminated diets, directly impacting production and indirectly initiating other metabolic disorders.

Additionally, toxins like aflatoxin and deoxynivalenol reduce feed intake and by consequence further suppression of nutrient supply. In dairy cattle, T2-toxin has been associated with intestinal hemorrhages, bloody faeces, gastrointestinal lesions and enteritis, finally disrupting the digestive process in the lower part of the digestive tract.

Molds also produce antibiotics to defend themselves against other mold and bacteria. ***Fig. 3*** shows some antibiotics produced by penicillium and aspergillus spp. present in silages. These antibiotic activities will suppress bacterial production in the rumen and lead to decreased feed conversion as well as 'normal' toxic effects of mycotoxins.

Fermentation extracts can maintain rumen functioning and performance even in the presence of mycotoxins. They supply micronutrients like B vitamins, branched chain fatty acids and oligopeptides to a variety of bacteria and protozoa and stimulate their growth and efficiency acting therefore as prebiotics.

Cellulolytic bacteria are especially supported and may be increased in numbers by about 50%, bacteria +15%. As a result, the digestibility of organic matter, ADF and hemicellulose are improved. The production of short-chain fatty acids can be increased, indicating higher energy supply from feed fibre.

Supporting immune function

Mycotoxins appear to have a significant immunotoxic potential, depending on the degree of exposure. Gliotoxin produced by A. flavus acts as an immunosuppressive, being antibacterial and improving apoptosis. These effects can be enhanced further by T-2 toxin, as it inhibits phagocytosis of A. fumigatus conidia by macrophages. Direct effects of T-2 toxin are seen in lower concentrations of plasma immunoglobulin, and protein. Cows in phases of stress as in early lactation or due to high temperatures are particularly susceptible to mycotoxins because their immune system is already overtaxed.
The interactions between the immune system and nutritional status or requirements are well documented. The requirement of the immune system is highly dependent on the immune response and applied conditions. The system is less stressed when vital organs such as the liver are fully functional.

The rumen has great potential to eliminate toxins, if the microflora is well balanced and very active. In addition, the immune system can be activated directly. B-glucans, as extracted and concentrated yeast cell walls, can activate leukocytes and cytokines. Cytokines are peptides and some regulate growth and differentiation of cells, others are mediators of immunological reactions. The stabilization of the immune system results in fewer cases of mastitis, and lower concentration of somatic cell count.

Conclusion

At the beginning of lactation, during high mobilization of body reserves and with high feed bypass through the rumen, the cow can barely cope with an additional burden like mycotoxin contamination. A multi-functional approach should be used to maintain and to stabilize the health of the cow naturally. Innovad's Escent® can keep the liver and kidney healthy, as well as keeping the rumen highly productive, resulting in more milk. ■

Escent® is not available in the USA and Canada.

Mycotoxins Risk Assessment

"….The biggest challenge in the mitigation of toxins contamination is the ability to properly detect the risk we are confronted with…"

Prof Trevor Smith , University of Guelph, ON, Canada

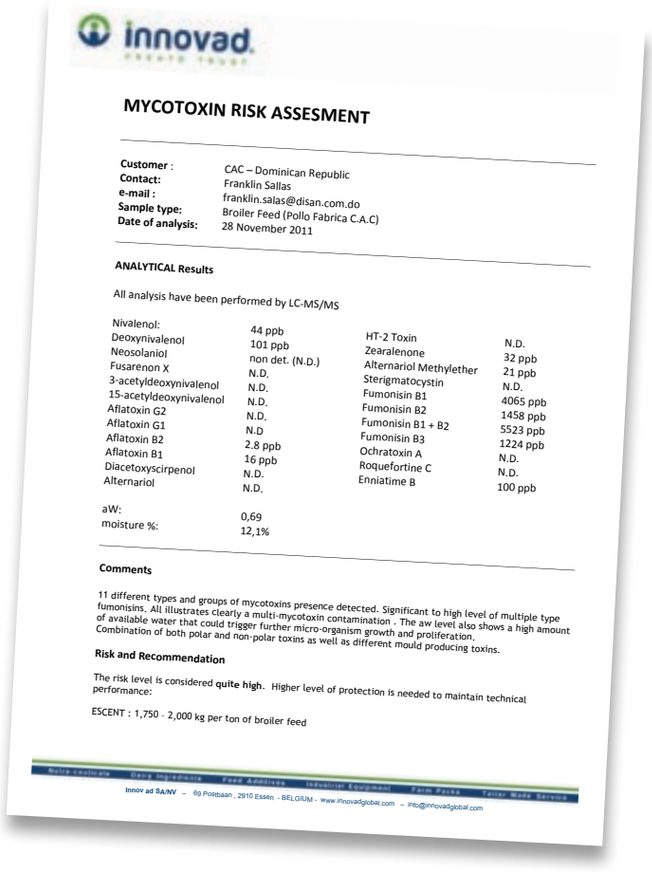
INNOVAD® has developed a specific service to help assess the potential contamination risk and performance losses related to the presence of toxins. Making use of analytical techniques and an own database, INNOVAD® offers practical solutions based on accurate recommendations.

Samples are collected and sent for analysis following LC-MS/MS procedure.

From **6 to 22 mycotoxins** can be analyzed , along with 3 other key indicators (moisture, pH, aW). Basic information about sample feed history, raw materials usage and animal specie & age feed application are compiled along with analytical results. All data are put in INNOVAD® data base and processed by INNOVAD® technical experts for risk calculation.

With this tool, INNOVAD® can

- Perform mycotoxin analytical assays
- Analyze the results, compare with data base
- Evaluate the potential contamination risk based on analytical results, historical information, specie/age and health status of the animals and environment pressure
- Provide a Mycotoxin Risk Assessment Report & Diagnosis per sample
- Make an accurate recommendation on how to use **Escent®**
- Keep data base per client
- Provide trend and analysis on risk evolution



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MYCOTOXIN RISK ASSESMENT

Customer : CAC – Dominican Republic
Contact: Franklin Sallas
e-mail : franklin.salas@disan.com.do
Sample type: Broiler Feed (Pollo Fabrica C.A.C)
Date of analysis: 28 November 2011

ANALYTICAL Results

All analysis have been performed by LC-MS/MS

Nivalenol:	44 ppb	HT-2 Toxin	N.D.
Deoxynivalenol	101 ppb	Zearalenone	32 ppb
Neosolaniol	non det. (N.D.)	Alternariol Methylether	21 ppb
Fusarenon X	N.D.	Sterigmatocystin	N.D.
3-acetyldeoxynivalenol	N.D.	Fumonisin B1	4065 ppb
15-acetyldeoxynivalenol	N.D.	Fumonisin B2	1458 ppb
Aflatoxin G2	N.D.	Fumonisin B1 + B2	5523 ppb
Aflatoxin G1	N.D	Fumonisin B3	1224 ppb
Aflatoxin B2	2.8 ppb	Ochratoxin A	N.D.
Aflatoxin B1	16 ppb	Roquefortine C	N.D.
Diacetoxyscirpenol	N.D.	Enniatime B	100 ppb
Alternariol	N.D.		

aW: 0,69
moisture %: 12,1%

Comments

11 different types and groups of mycotoxins presence detected. Significant to high level of multiple type fumonisins. All illustrates clearly a multi-mycotoxin contamination . The aw level also shows a high amount of available water that could trigger further micro-organism growth and proliferation.
Combination of both polar and non-polar toxins as well as different mould producing toxins.

Risk and Recommendation

The risk level is considered **quite high**. Higher level of protection is needed to maintain technical performance:

ESCENT : 1,750 - 2,000 kg per ton of broiler feed

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Mycotoxin Analysis
Analytical Report

Report ID: US15-D-SEP25-003
Received Date: September 25, 2015
Printed Date: September 29, 2015

Innov ad NV/SA
Mike Collins
33 Eagle Drive
Rehoboth, Delaware 19971

Sample ID: X15-001120
Sample Number: 1
Sample Description: [redacted] TMR
Submitted For: [redacted]

Mycotoxin	Value (Dry Basis)	Units	RL	Method ID
Aflatoxin B1	< 1	ppb	1	AGR DI M 1.2
Aflatoxin B2	< 1	ppb	1	AGR DI M 1.2
Aflatoxin G1	< 1	ppb	1	AGR DI M 1.2
Aflatoxin G2	< 1	ppb	1	AGR DI M 1.2
Deoxynivalenol (DON)	1.17	ppm	0.06	AGR DI M 1.2
3-Acetyl-Deoxynivalenol	< 0.06	ppm	0.06	AGR DI M 1.2
15-Acetyl-Deoxynivalenol	0.30	ppm	0.06	AGR DI M 1.2
Fumonisin B1	< 0.1	ppm	0.1	AGR DI M 1.2
Fumonisin B2	< 0.1	ppm	0.1	AGR DI M 1.2
Ochratoxin A	< 0.003	ppm	0.003	AGR DI M 1.2
T-2	< 0.06	ppm	0.06	AGR DI M 1.2
HT-2	< 0.06	ppm	0.06	AGR DI M 1.2
Zearalenone	0.03	ppm	0.03	AGR DI M 1.2
Diacetoxyscirpenol	< 0.06	ppm	0.06	AGR DI M 1.2
Sterigmatocystin	< 0.03	ppm	0.03	AGR DI M 1.2

Results Approved By: Michael Wyrebek

Michael Wyrebek, MSc

Risk assessment

		TMR Farm 1	TMR Farm 2
	Mycotoxins (ppb)	**1120**	**1121**
1	Aflatoxin B1		
2	Aflatoxin B2		
3	Aflatoxin G1		
4	Aflatoxin G2		
5	**Deoxynivalenol (DON)**	1.170	670
6	3-acetyldeoxyvalenol		
7	15-acetyldeoxyvalenol	300	130
8	**TOTAL DON**	1.470	800
9	Fumosin B1		
10	Fumosin B2		
11	Ochratoxin A		
12	T-2 toxin		
13	HT-2 toxin		
14	Diacetoxyscirpenol		
15	Sterigmatocystin		
16	Zearalenone	30	110

Number of mycotoxins
Level Risk

NOVIN S
Min dose (g/head/day)

Conclusions:

The main observation is that the level of DON contamination in the TMR represents a risk.
No polar toxins risk. No Afla.
All toxins are of non-polar form, so cannot be bound with simple clays only.
DON & conjugated form of DON and Zearalenone present are of non-polar form. There will be an impact on liver functioning. There will be an impact on gut integrity and intestinal barrier due to the presence of DON and Conjugated DON.
Such chronic and multiple mycotoxin contamination at above levels will impair rumen functioning.
This risk will generate possible inflammatory response.
Protection with NOVIN S is strongly recommended at above feeding rates.

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