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NDS Mycotoxins Evaluator

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Many cereal and other feeds are susceptible to fungal attack either in the field or during storage. These fungi may produce, as secondary metabolites, a diverse group of chemical substances known as **mycotoxins**. The primary classes of mycotoxins are aflatoxins of which aflatoxin B1 (AFB1) is the most prevalent, zearalenone (ZEA), trichothecenes - primarily deoxynivalenol (DON) and T-2 toxin (T-2) - fumonisins, ochratoxins (OTA) and the ergot alkaloids. There can be wide year to year fluctuations in the levels of mycotoxins in feeds, depending on many factors, such as adverse conditions favoring fungal invasion and growth. Many mycotoxins were initially identified after they had caused a variety of subacute health problems in livestock as well as humans. With modern farming, storage and processing practices, the aim is to reduce obvious contamination, and much of our concern now focuses on chronic effects at low levels of exposure.

Even though ruminants, in general, tend to be less susceptible to mycotoxins compared with monogastrics, these metabolites exhibit a variety of biological effects in animals: liver and kidney toxicity, central nervous system effects and estrogenic effects, to name a few. Some mycotoxins, i.e., aflatoxin, fumonisin and ochratoxin, are carcinogenic. As these toxicants can never be completely removed from the feed supply, in general have been defined levels in feeds (tolerances, guideline levels, maximum residue levels) that are unlikely to be of health concern even though the lack of a unified and transparent approach results in a wide range of guidelines/regulations.
Starting from the consideration that, from time to time, the presence of mycotoxins may render forages and feed commodities unsafe (e.g. byproducts derived from ethanol production), requiring a variety of measures to reduce risk and, therefore, monitoring for the presence of mycotoxins is needed, the development group at RUM&N developed the tool called **NDS Mycotoxins Evaluator**. The tool is designed to monitor occurrence and concentrations of mycotoxins in each single feed included in the recipes, to evaluate total mycotoxins intake and concentration, comparing these value with customizable maximum tolerable limits.

The **NDS Mycotoxins Evaluator** should be useful to analyze and evaluate the risk of mycotoxins in the recipe in order to define the proper risks management with the goal to minimize mycotoxins effects.

Mycotoxins feed contents

The first step should be to check the mycotoxins concentrations in the main feeds included in diet, especially those considered at greatest risk. Testing for mycotoxins should be mostly considered when signs of potential effects on performance and health exist and cannot be readily explained. This is particularly important when moldy feeds are being fed or when marked changes in production or health have occurred among a relatively large proportion of animals.
Mycotoxins testing results can be edited and saved in the **NDS** through the *Mycotoxins* tab included in the **Feeds** section of the platform. Alternatively, they can also be electronically imported via the Standard XML file provided by many laboratories.

It is important to note that the values are saved at farm level in order to differentiate the values not only according to the type of feed but also based on the farm in which the contaminated feed is used. For instance, we can feed corn grain through recipes of different farms but it may not be contaminated in every farm.

Recipe mycotoxins evaluation

The **NDS Mycotoxins Evaluator** tool allows to monitor and evaluate the impact of mycotoxins on a recipe. Based on the amount of contaminated feeds included in the recipes, this evaluator estimates qualitative and quantitative supply of the

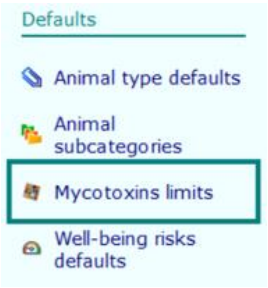
main mycotoxins. It also compares current concentration vs. the maximum tolerable concentrations and the total mycotoxins supply vs. the tolerable daily intake limits defined for the animal type you are formulating.

Mycotoxins evaluator

Report

Feeds			AFB1	DON	ZEA	T-2	FUM	OTA
	As fed lbs	DM lbs	ppb	ppb	ppb	ppb	ppb	ppb
Corn silage 32.4432 NF=15_0277	49,026	15,772	26,7					
Alfalfa hay 45.19 NF=1536	11,131	9,788						
Avena Fieno 62.06 NF=1541	4,452	3,945						
Corn grain fine 63%	12,604	11,263	21,7					
Soybean meal 47% NF=16_0479	6,844	6,061	3,7					
Frum. duro crusca 20-21% Amido	5,685	5,014						
Soybean steam flaked	1,741	1,565						
Beet pulp pellet								
Sunflower meal 34-35% NF=16_0481	1,810	1,648						
Barley grain gr - PGO=I18261	1,330	1,168						
Neofat	0,579	0,562						
MIN-VIT 1/10 - v2015	0,636	0,622						
Soy Plus								
Potassium Carbonate	0,249	0,245						
Intake (lbs/d)	96,086	57,651						
Current concentration (ppb)			2,0					
Maximun tolerable concentration (ppb)			20,0	250,0	250,0	100,0	35.000,0	200,0
Total (ppb/d)			52,1					
Tolerable limits (ppb/d)			523,0	6.537,5	6.537,5	2.615,0	915.250,0	5.230,0
Differences (ppb/d)			-470,9					
Differences %			-90,0					

Given the wide range of guidelines and regulations available around the world and the uncertainty in defining overall accepted tolerable limits, the tool allows to customize these tolerable limits for each type of cattle. The customized tolerable limits can be set through *Utility* tab, *Defaults* list of command.



Mycotoxins - Maximun tolerable concentrations (ppb, micrograms/kg)

Reset default values | Close

Animal Type	AFB1	DON	ZEA	T-2	FUM	OTA
Lactating Dairy Cow	20	250	250	100	35000	200
Dry Cow	20	1000	250	100	35000	200
Replacement heifers	25	1000	250	100	35000	200
Beef Cattle	25	1000	250	100	35000	200
Young Calf	10	1000	250	100	15000	200
Lactating Beef Cow	25	1000	250	100	35000	200

Aflatoxin B1 and Aflatoxin M1

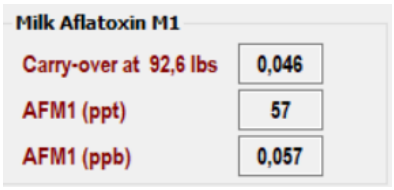
Since Aflatoxin B1 (AFB1) in feed can be transferred into the milk as Aflatoxin M1 (AFM1), dairy cattle will produce milk contaminated with AFM1 after consuming feeds contaminated with AFB1. For this reason, the carry-over of AFB1 from contaminated feed into milk is of special interest and the AFMI concentration in milk is regulated by law in many countries.

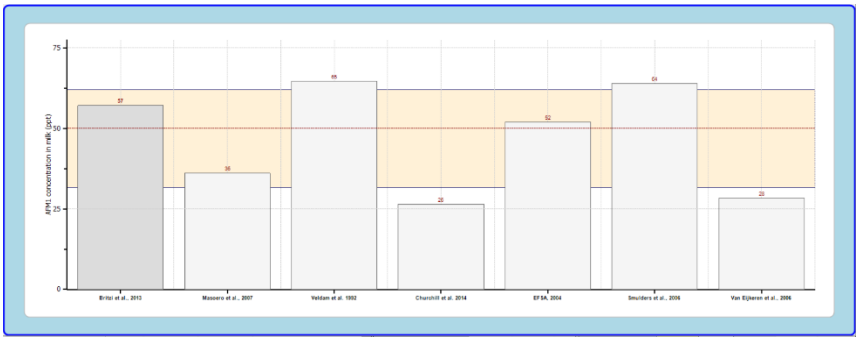
Once AFM1exceeds the regulatory limits (Table. 1), the AFM1 contaminated milk, by law, has to be discarded to prevent it from getting back into the food chain. AFM1 contamination in milk occurs often (not always above regulatory limits) because AFB1 often occurs naturally in grains, by-products, and roughage.

Table 1: Global regulation of aflatoxin M1 (AFM1) in milk

Countries	AFM1 Concentration in Milk
EU Countries	Less than 0.05 ppb (50 ppt)
USA, Canada, China, Japan, Mexico, etc.	Less than 0.5 ppb (500 ppt)

For these reasons, it may become important to be able to foresee the AFB1 carry-over rate from contaminated feed into milk in any specific production situation, in order to assess whether there are risks of exceeding the legal limits.
The **NDS Mycotoxins Evaluator** includes a special section able to foreseen whether the current levels on Aflatoxin B1 in feed for lactating animals is sufficient to keep Aflatoxin M1 levels in milk below the thresholds as reported in Table 1.
We adopted the model proposed by Britzi et al. (2013) in which the carry-over appears to increase exponentially with milk yield. It seems to well describe the conditions of high-production cows that will a higher carry-over percentage when compared with that has been suggested by previous studies using low-producing cows. However, the expected value is compared with predictions made by other published models, in order to evaluate the sensitivity of the proposed data.





This approach should be of help to detect risky situations with the resulting possible decisions that can be made, which may include the substitution of contaminated feeds or the addition of mycotoxin binders to contaminated diets with the goal to reduce the effects of mycotoxins.

NDS Mycotoxins Evaluator should make farmers and nutritionists more sensitive towards a proper harvesting, storing, and regular testing of feedstuffs for dairy cows to ensure the safety of the animals and the humans consuming their products.

Send us your comments on this topic! Dave is at rumendvm@gmail.com; Buzz is at bburhans@dairynutritionhealth.com

Note that the features and utilities developed by the NDS team described above are not components of the underlying CNCPS model, and do not change the CNCPS outputs or results. *Questions about use of these features should be directed to the NDS support team, and not to the CNCPS group at Cornell.*

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