EquiPage

NUTRITION AND OTHER TOPICS OF INTEREST TO THE HORSE INDUSTRY.

Mycotoxins in the Equine Diet

Amy Parker, M.S.

Mycotoxin contamination of grains and forages can pose a significant health risk to horses. These risks include immunosuppression, organ damage, colic, poor growth, detrimental effects on reproductive performance, and death. Diagnosis of mycotoxicosis can be difficult, as the symptoms are often vague. Age, general health, and immune status combine to determine each horse's susceptibility to mycotoxins. Minimizing or eliminating exposure to mycotoxins is imperative to maintaining the horse's health.

How do mycotoxins develop?

Under favorable environmental conditions, mold will begin to grow on stored grains and hays. While several factors contribute to mold growth, the single most important factor is often relatively high moisture, either at harvest or during grain or forage storage. Other contributing factors include plant stress (e.g., drought followed by very wet conditions; harvesting in wet conditions; inappropriate application of fertilizers or pesticides), high humidity, and insect infestation. As the fungi grow, they produce secondary metabolites. In some cases, these metabolites can be useful, such as in the case of antibiotics. Unfortunately, some of these metabolites, called mycotoxins, are harmful to humans and animals.

Molds that produce mycotoxins are present in many livestock feedstuffs, the most commonly affected being tall fescue, corn, peanuts, and cottonseeds. All cereal grains and forages have some level of susceptibility to mold and mycotoxin development. Mycotoxins in plants and stored grains and forages can form in as little as a few hours in the right environmental conditions.

Types of mycotoxins

Over 400 mycotoxins have been identified, but scientists believe there are many more yet to be identified. The effects of mycotoxins on horses are not well documented in scientific literature. In the field, however, mycotoxins have shown several harmful effects. Most scientific research has focused on acute, relatively high exposure to mycotoxins. The effects of low level exposure over a prolonged period of time have not been extensively studied, but are speculated to cause a gradual deterioration of organ function and to weaken the immune system.

<u>Fumonisins</u>

Leukoencephalomalacia, also known as blind staggers or moldy corn disease, is the result of ingesting corn or corn plant products contaminated with *Fusarium moniliforme*. This mold produces the mycotoxin fumonisin.

Contamination of corn usually occurs before the harvest. Affected corn kernels typically appear pink to reddish brown, but any portion of the plant may be affected. Fumonisins typically form in humid climates, especially when a drought is followed by high amounts of rainfall (e.g., dry summer, wet autumn). Older horses tend to be more susceptible than younger horses.

Horses suffering from leukoencephalomalacia exhibit neurologic symptoms. Symptoms progress rapidly within several hours to a couple of days of ingestion of contaminated corn. Initially, affected horses have reduced feed intake and show signs of depression and lethargy. Symptoms quickly progress to include facial paralysis, blindness, circling, head pressing, staggering and general incoordination, and recumbency. Often, the only symptom is death. Necropsy results show a liquefying of the white matter in the brain.

Preventing leukoencephalomalacia involves not feeding contaminated corn or corn plant products. Corn should be analyzed for fumonisin contamination. Storing corn at low moisture levels (below 13%) will help prevent molding.

Aflatoxins

Aflatoxicosis is considered rare in horses and occurs when contaminated grains or grain by-products are fed. Aflatoxins are most commonly produced by *Aspergillus flavus* and *Apergillus parasiticus* molds. These molds usually form on corn, peanuts, and cottonseeds, but can also occur on other cereal grains and very occasionally hay and straw. While aflatoxins may form in the plant, they usually are the result of a grain or forage storage problem. Specifically, storing grains at a high moisture level (>13%) or failing to clean harvesting equipment, augers, and storage bins before each use can increase the risk for aflatoxin development.

Distiller's dried grains (DDG) from ethanol and alcohol production are susceptible to mycotoxin contamination. In fact, when corn or grain sorghum contaminated with aflatoxins is used, ethanol production appears to concentrate aflatoxins in DDG. Some researchers have found as much as three times the amount of aflatoxins in DDG from ethanol production as that found in the initial corn or grain sorghum. Additionally, aflatoxin contamination can occur if DDG are not properly dried after alcohol or ethanol production. This is not to say that all DDG are harmful. DDG originating from uncontaminated grains or that are properly dried and handled can be good sources of protein and B-vitamins.

The onset of poisoning occurs in a relatively short amount of time in horses, with symptoms appearing within a few days of exposure to very small amounts (1000 parts per billion [ppb] of dry diet). The first sign is often feed refusal. Other signs of aflatoxicosis are vague and include decreased feed and water intake, weight loss, lethargy, and sometimes bloody diarrhea. The most telling symptom, however, is liver damage that may or may not be reversible. In some cases, death may occur. Young horses tend to be most susceptible and most severely affected. Low level exposure (as low as 100 ppb dry diet) over a prolong period of time is thought to decrease growth and impair immunity.

Storing grains, hays, and straw at a low moisture content and cleaning all harvesting equipment and storage areas will help prevent mold development. Feedstuffs known to be at risk for high levels of aflatoxins (e.g., peanut hulls, cottonseeds, improperly dried DDG, DDG from ethanol production, etc.) should be avoided in equine diets.

Slaframine

Legumes, particularly red clover and alfalfa, may be infected with the fungus *Rhizoctonia leguminicola*, which produces an alkaloid mycotoxin called slaframine. The mold develops on the plant leaves under wet and humid conditions usually in the spring or fall. Symptoms of slaframine poisoning occur after several days of eating infected forage. Both fresh pasture and hay can elicit symptoms.

The most noticeable symptom of slaframine toxicity is excessive salivation; thus the disorder is commonly referred to as "slobbers." Other signs can include increased drinking, weight loss, diarrhea, and frequent urination. Because of the increased salivation, horses may be at risk for colic or dehydration. Recovery is quick once the infected forage is removed from the diet.

Because the mold can form fairly quickly, even following a heavy dew, and many pastures contain several varieties of clover, prevention can be difficult. The only preventative measure is not grazing or feeding hay from infected plants.

Ergot alkaloids

Ergotism

Claviceps purpurea and *Claviceps paspali* can be found in the seeds of a variety of grasses (e.g., bluegrass, bromegrass, ryegrass, etc.) and in cereal grains, including rye, wheat, and barley. These molds form a hardened, mycotoxin-containing sclerotia, known more commonly as ergot. The sclerotia (ergot bodies) appear as dark purple to black spots in the heads of cereal grains and grasses. In fact, the entire grain can be replaced by the fungus. The mycotoxin is unique in that it only forms during the flowering and seed maturation stage rather than in the mature plant or seed. Hot, damp, humid weather is conducive to ergot formation.

Ergot alkaloids are the causative agents and are poisonous to all animals and humans. While horses rarely suffer from ergotism, affected horses have shown reproductive effects similar to those of fescue toxicosis. Mares consuming infected ryegrass seeds showed lack of udder development, thickened placentas, dystocia, retained placentas, poor colostrum and milk production, prolonged gestation, and abortions. Foals born to mares consuming infected feed were often weak or stillborn.

Prevention of ergotism generally involves forage management. Planting ergot-free pastures is the most obvious preventative measure. Mowing pastures or harvesting hay and straw prior to the flowering stage of the plant will help reduce or prevent sclerotia formation. Grains should be tested for ergot and not fed to horses if contamination is confirmed.

Fescue toxicosis

One of the most common mycotoxicosis occurs when broodmares consume endophyte infected tall fescue. (An endophyte is a parasitic organism [e.g., mold] that grows within the host's body [e.g. plant].) Tall fescue is a cool season, perennial grass used for grazing and hay. Certain varieties of fescue are infected with an endophytic mold called *Acremonium coenophialum*. The endophyte

moves up the plant stem and into the seed, and new plants are re-infected via natural reseeding rather than by plant to plant contamination. Because it is an endophytic mold, it grows inside the plant rather than on the outer portions; thus, the outer appearance of the grass is unaffected (mold cannot be seen). *A. coenophialum* produces ergot alkaloids, which may be responsible for the toxicosis, although this has not been confirmed.

Fescue toxicosis is responsible for a multitude of reproductive problems in the horse, including prolonged gestation (>12 months), lack of udder development, lack of colostrum and milk production, thickened placenta, retained placenta, dystocia, premature placental separation, and weak or stillborn foals at birth. Toxicosis most commonly occurs when pregnant mares are allowed to graze infected pastures, especially mature pastures since the endophyte occurs in the stems and seeds only. If harvested when mature and seedheads are present, infected fescue hay may also pose a threat.

Because the endophyte spreads through the stem and is carried in the seed, prevention generally involves grazing or feeding hay of the endophyte-free varieties of fescue. Pregnant mares must be removed from endophyte-infected fescue pastures or hay the last 90 days of gestation to minimize the effects of fescue toxicosis.

Tremorgenic mycotoxins

In addition to ergot alkaloids, *C. paspali* also produces tremorgenic mycotoxins. *C. paspali* most often occurs in Paspalum grass seedheads, such as Dallis and Bahia grasses. The mold only invades the flower and forms a sticky substance referred to as "honeydew". Insects are attracted to the honeydew and aid in distributing the mold. Eventually the honeydew dries and a sclerotia containing the mycotoxin forms.

Perennial ryegrass can be infected by the endophytic mold *Acremonium lolii*, which produce alkaloid tremogenic neurotoxins. This mycotoxin develops on the lower outer leaf sheath and seeds. The lower the plant is grazed, the greater the exposure to the mycotoxin.

Both mycotoxins are thought to be responsible for a condition known collectively as grass staggers, as fresh pasture, hay and straw may result in symptoms. While these are two separate mycotoxicoses, the symptoms are essentially the same. Symptoms occur after several weeks of continual consumption of contaminated forage. Signs vary from mild excitability and muscle tremors to spastic, jerky gait, exaggerated leg movements and occasionally seizures. Once the infected forage is removed from the diet, complete recovery generally occurs over several weeks or months.

Paspalum staggers can be prevented by mowing pastures or harvesting hay prior to the flowering stage to prevent sclerotia formation. Perennial ryegrass staggers can be avoided by using endophyte-free varieties of ryegrass (or other forages) and not overgrazing pastures.

Are there safe levels of mycotoxins for equine diets?

Because prolonged, low level mycotoxin exposure has not been extensively studied in horses, mycotoxins should be avoided in the diet. Scientists believe that extended ingestion of mycotoxins may compromise the horse's immune system, making them more susceptible to infection. Extended exposure, even at very low levels, is also thought to impair growth and may negatively effect reproduction.

Seeing mold on plants, grains, or hay does not necessarily confirm the presence of mycotoxins. Conversely, mycotoxins can still be present even though mold is not visible. Care must be taken during growth, harvesting and storage of feedstuffs to minimize conditions that would allow mold to form. The best preventative measure includes avoiding high risk feedstuffs in the diet. Bales of hay or bags of grain/feed that show any sign of mold should be discarded entirely.

References

Hintz, H. F. The Veterinary Clinics of North America Equine Practice. August 1990, 6 (2): 419.
Lewis, Lon D. 1995. Equine Clinical Nutrition Feeding and Care. Williams & Wilkins: Media, PA.
Nutrient Requirements of Horses: Sixth Revised Edition. 2007. National Research Council of the National Academies: Washington, D.C.
The Merck Veterinary Manual: Seventh Edition. 1991. Merck & Co.: Rahway, NJ.
Understanding and Coping with Effects of Mycotoxins in Livestock Feed and Forage. North Carolina State University Cooperative Extension. September 2007.
agdev.anr.udel.edu/weeklycropupdate/?tag=fusarium-ear-rot-of-corn
pubs.caes.uga.edu/caespubs/pubcd/B1231.htm
www.ag.ndsu.edu/pubs/plantsci/crops/pp551w.htm
www.omafra.gov.on.ca/english/livestock/horses/facts/info_slobbers.htm

Customer Focus: Dan & Staci Henry of Fayetteville, PA

by: Cindy Smith


January 2008

Dan and Staci Henry acquired Pilot in January of 2008. Pilot was a 9 year old ex-racehorse who found himself in an unfortunate circumstance. The Henry's were first-time horse owners and were faced with the daunting task of nursing Pilot back to health in the middle of winter. Pennsylvania winters can be quite cold and snowy, and they had to work quickly to make certain that Pilot gained the weight he desperately needed.

Upon the initial evaluation, Pilot was assigned a body condition score of 1.5. He was approximately 16 hands, and weighed less than 850 pounds according to a weight tape. A veterinary assessment was performed, and Pilot was given a doubtful prognosis. The Henry's worked very closely with McCauley Equine Center in Chambersburg, PA and McCauley's nutritionists, Amy Parker and Dr. John Lew, in Kentucky. Pilot was immediately offered several small meals throughout the day consisting of McCauley's Alam and McCauley's Rice Bran Oil. He was also given free-choice, high quality orchard grass hay.


June 2008

Following a strict regimen of Alam and Rice Bran Oil, Pilot gained nearly 100 pounds (by weight tape) over the next month. His weight and body condition continued to improve steadily throughout the Spring. By June of 2008, one would never be able to determine that the sleek, muscled gelding was the same one presented just a few short months prior.

Pilot is now enjoying his days grazing on shaded mountain pastures and being well taken care of by the Henry's 13 year old daughter, Paige. He has even been lightly ridden a few times.

McCauley's Quality Assurance Program

McCauley's has always had one goal in mind...to help raise sound, healthy horses. To that end, McCauley's implemented quality control standards to ensure that McCauley's feeds and supplements are the best. McCauley's understands that the only way to make make excellent quality feeds and supplements is to use excellent quality ingredients. Some of McCauley's quality control standards include:

♦Highest standards of grain selection in the industry. For example:
-Oats *must* have a minimum weight of 42 pounds per bushel, regardless of whether they are used in McCauley's pelleted or textured feeds.
-Corn specifications are better than human grade and *must not contain detectable levels* of aflatoxins and fumonisins.
♦*No* animal drugs or ionophores are allowed on McCauley's premises.
♦Trucks and freight cars that bring ingredients to both McCauley's mills are *certified* that they have not carried any animal by-products, drugs, ionophores on at least the previous load.
♦McCauley's feed mill was designed *specifically* to manufacture equine feeds and supplements.
♦McCauley's formulas are fixed and *do NOT change* with changing ingredient costs.
♦ISO 2009/HACCP certified.

These standards are applied year after year, day after day, to every batch of McCauley's feeds and supplements. Regardless of economic conditions or changes in commodities prices, McCauley's will not lower our quality assurance standards. This is the commitment McCauley's has to it's customers....always has been, always will be.

McCauley Bros., Inc
111 Broadway
Versailles, KY 40383
800-222-8635
859-873-3333

www.mccauleybros.com