



Feed Contaminants and Additives Potentially Toxic to Horses

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Feed additives and contaminants that can have toxic or undesirable effects in a horse's diet should be of interest to the feed microscopist. Two areas where this information can be used are quality control, to prevent the horse from being exposed to toxins, and investigation into the cause of an illness or death.

The quality-control microscopist evaluates ingredients going into horse feeds to be sure that they meet certain standards. He/she evaluates the ingredients by checking for overall aesthetic quality, contaminants, adulterants, or the presence of mold.

To determine the cause of an illness or death, everything the horse has ingested must be investigated. This includes not only the grain mix, but any hay, pasture, bedding, water, and other substances that were available to the horse.

The feed additives and contaminants that follow will be listed by the source of feed where they are most commonly found. The sources are grains and grain mixes, forages (hay and pasture), bedding, and water.

This will not be a complete list, but rather a list of the most common substances that can cause problems. We must remember that almost anything can be toxic if large enough quantities are ingested.

Grain and Grain Mixes

1. Feed Additives (other than medications)

Non protein nitrogen (NPN) compounds are often fed to ruminants as an economical source of protein. Most NPN is in the form of urea, although other forms are also used. Urea is one feed additive that horses are less susceptible to than ruminants. Urea is usually lethal at 1-1.15 g/kg body weight, but 0.3-0.5 g/kg may be toxic; in horses, 4 g/kg body weight is lethal (3). Ideally, a urea level in the feed which is safe for cattle should also be safe for horses. However, the horse's digestive system is not constructed to efficiently utilize NPN, so they are not used in horse feed.

2. Feed Contaminants

By definition, a contaminant is a substance that makes another substance impure or unfit for use. Therefore, the list of feed contaminants is almost endless; this should not be confused with adulteration of feed, which is the intentional use of foreign or inferior substances. To limit the subject, only the most common contaminants found in feedstuffs will be discussed.

- Molds and Mycotoxins

Mycotoxins are secondary toxic metabolites produced by molds. One of the more recent mycotoxins to be identified is fumonisin, which is produced by *Fusarium moniliforme* and *F. Proliferatum*. Fumonisin B₁ causes equine leucoencephalomalacia (ELEM) commonly called "moldy corn poisoning" or "cornstalk disease."

Clinical signs of ELEM are frenzy, circling, blindness, head pressing, sweating, and hyperexcitability. Convulsions may precede death. Liquefactive necrosis of the white matter of the brain is the primary pathologic feature and also the reason for the name "spongy brain syndrome." The signs usually appear abruptly, and death can occur within two or three days.

Aflatoxins produced by *Aspergillus flavus* and *A. parasiticus* are found primarily in corn. Liver damage is the most likely sequel to aflatoxicosis, although kidney damage can also occur.

Zearalenone and deoxynivalenol (DON) can also cause problems in horses. However, most horses will not eat feed contaminated with these mycotoxins unless they are starved, or they are in another feed ingredient that masks the taste and smell of the mycotoxins.

- Other Contaminants

Some compounds found in grain mixes may not be toxic, but can cause the disqualification of horses in competition if detected in the urine. Theobromine is one of these substances. Produced by the cacao bean, in horse feeds it is found primarily in bakery products containing chocolate (2).

Forages (Hay and Pasture)

1. Forage Contaminants

- Mold and Fungus

Tall fescue (grown on approximately 40 million acres) is the most widely grown forage in the United States. It can be a very safe, inexpensive source of forage for horses. However, it can become infested with a fungus that causes many problems, primarily related to foaling. The fungus is an endophyte (grows inside the plant) that does not

adversely affect plant growth. The primary problems associated with ingestion of infected fescue are abortions, prolonged gestations, dystocia, agalactia, and thick or retained placentas. The end result is increased foal and mare deaths.

Sweet clover is an important forage crop in some areas of the country. Sweet-clover poisoning, caused by dicumerol, is produced from coumarin in plants that are infected with various species of *Penicillium*. Mold-free sweet clover hay is difficult to produce because the thick stems are difficult to dry. Dicumerol interferes with vitamin K needed for normal blood clotting; thus, the horse can hemorrhage internally.

Red clover can also be high-quality forage for horses. However, if harvested too wet, red-clover hay can be infected with *Rhizoctonia leguminicola*, which may produce a mycotoxin called slaframine. This causes animals to slobber profusely; the condition is commonly called "slobbering disease" or "blackpatch." It is generally not life-threatening, but does cause alarm. The slobbering usually subsides within 48-96 hours after removal of the affected hay.

- Other Contaminants in Forages

Alfalfa hay grown in the southwestern United States may be infested with blister beetles. Blister beetles are attracted to the bloom of alfalfa plants and are crushed during the processing. The beetles contain cantharidin, which irritates the mucous membranes of the digestive tract. The horses develop a fever, colic, the sweats, and very severe, watery diarrhea. Only five to six beetles/horse/1,000 lb. body weight can cause death in less than 48 hours.¹ There is no antidote. Blister beetles are about ¼ inch wide and ¾ inch long. They can be several colors, but have very distinctive heads and long, narrow bodies. It is very important to remember that, even though blister beetles are not likely to be a problem in the eastern United States, the hay could have come from another area of the country.

Prussic acid (cyanide) poisoning can cause death in horses. Toxic levels often accumulate in the leaves of a number of plants, including sorghum, sudangrass, hybrids of the two, Johnsongrass, and wild cherry. Prussic acid is most likely to accumulate after a killing frost or during rapid growth after a drought. Wild cherry can be a problem after a windstorm, when branches are broken off the tree and the leaves wilt. Death is caused by suffocation due to interference with the oxygen-transferring ability of red blood cells; the blood is cherry red in animals affected by prussic acid.

Some plants accumulate nitrates during stress periods and/or after heavy fertilization with nitrogen. The plants most likely to accumulate nitrates are sudangrass, sorghum-sudan hybrids, corn, wheat, and oats. Some weeds found in hay, such as nightshade, goldenrod, smartweed, ragweed, and lambsquarters, can also accumulate nitrates. Clinical signs of nitrate poisoning include labored breathing, staggering, muscle spasms, and death. The blood is coffee-colored due to decreased oxygen-carrying ability of the hemoglobin.

Selenium levels in soils and plants vary greatly from one area of the United States to another (1). Most selenium toxicities in horses are due to consumption of secondary accumulator plants (those plants that accumulate selenium). Other plants that require high-selenium soil to grow are called "indicator plants." They can build up 100 times or more selenium than other plants grown in the same soil. Locoweeds, woody aster, goldenweed, and prince's plume are some plants that can produce selenium poisoning. They are toxic when eaten fresh or dried.

Foxtail can cause ulceration of the lips and mouth due to its porcupine quill-like awns. The plant itself is not toxic, but the horse will be unable to eat normally until the ulcers heal.

- **Toxic Plants**

The yew and many other ornamental plants are toxic to horses. All parts of the yew are poisonous, either fresh or dried (4). Death can occur within minutes of eating as little as one pound of the plant. The horse will quiver and then drop suddenly as if shot. Once signs appear, it is generally too late for treatment. Most horses will not preferentially eat yew, but problems occur when grass clippings containing yew trimmings are fed to horses. In the winter, the green yews also appear to be more attractive to animals.

Bracken fern is also toxic because it causes a thiamine deficiency, but it is not nearly as poisonous as yew. Twenty to twenty-five percent of the total diet would have to be bracken fern to be fatal. Unfortunately, bracken fern is very palatable; if available to the horse, the horse will eat it.

Black locust, red maple, black walnut, and oak trees can be toxic to horses. Some of these have toxic leaves, while others, like the black walnut, are totally poisonous.

Bedding

If used for bedding, black walnut shavings can be a problem. Juglone is the toxic substance in these shavings. They will cause problems if ingested or if they make contact with the skin. Within 12-24 hours after contact, the horse will develop signs of acute laminitis. They can recover and live with laminitis, but if it is severe, death can occur.

Water

Water contamination can be a problem in some areas. Runoff from strip mines and the brine water from gas and oil wells can cause mineral imbalances. Water that is extremely high in some elements can be toxic or interact with other elements that negatively affect the animal's health.

Summary

Feed additives and contaminants that are potentially toxic to horses are numerous. Fortunately, horses are very selective eaters and will not usually consume toxic substances under normal circumstances. In areas where pastures are short or when severe weather has destroyed forages, animals are sometimes forced to eat toxic plants. Horses that are kept in barns or dry lots may also be less selective when turned out to pasture.

If toxic plants or other toxic contaminants are harvested in hay, it is more difficult for the horse to distinguish and separate the toxic portion. Under this circumstance, horses are more likely to eat something that is toxic, even though adequate feed is provided.

Grains and grain mixes can contain additives and contaminants that may or may not be palatable to the horse. Even if the toxic substance is unpalatable, molasses or other flavorings can mask the taste. Again, if the horse is very hungry, it may eat grains that would normally be rejected.

If a toxicity problem occurs in a horse, it is important to obtain a complete, detailed history. This should include samples of all feedstuffs, bedding, and water. All pastures and turnout lots should be inspected for any sources of potential toxins. The combination of a complete history and samples should help provide an answer to the cause of the problem.

With improved animal management taking into account the different seasons, along with utilizing microscopy with good quality control of all feedstuffs, it is possible to greatly reduce the incidence of contaminants affecting animal health.

References

1. Osweiler, G.D., T.L. Carson, W.B. Buck, and G.A. Van Gelder, *Clinical and Diagnostic Veterinary Toxicology*, 3rd Ed. Kendall/Hunt Publishing Co., Dubuque, IA, 1985.
2. Hintz, H.F., *Compounds in Feeds That Can Cause Disqualification of Performance Horses*, Cornell University, Ithaca, NY.
3. Naylor, J.M., and S.L. Ralston, *Large Animal Clinical Nutrition*, Mosby Yearbook, Inc., St. Louis, MO, 1991.
4. Ball, D.M., C.S. Hoveland, and G.D. Lacefield, *Southern Forages, Potash and Phosphate Institute*, Atlanta, GA, 1991.

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