

MOLDY CORN

a RISKY Ingredient for Horses

FARMERS across the Midwest struggled last year to harvest their crops in what turned out to be an unseasonably wet autumn. These conditions led to reports of widespread mold in this year's corn crop. Moldy corn is a hazard for all species of livestock, but horses are particularly sensitive to certain toxins produced in moldy corn.

Fumonisin is a toxic substance produced by at least two species of fungus—*Fusarium verticillioides* (an older synonym is *moniliforme*) and *Fusarium proliferatum*—that grow on corn. Unlike some fungus or mold species that cause problems in stored grain, fusarium grows on corn plants before they are harvested. Stress from weather or insect damage can make plants more susceptible.

In wet growing seasons or areas with high humidity, close to 100% of the plants may be affected.

The effects of fumonisin contamination are considerably more hazardous to horses than other livestock. When fed corn contaminated with fumonisins for a period of several days to a few weeks, horses are at risk for the neurological syndrome equine leukoencephalomalacia (ELEM), also known as blind staggers or moldy corn poisoning.

The first sign of ELEM is reduced feed intake, which is typically followed by a battery of neurological symptoms: disorientation, head pressing, ataxia, hyperexcitability, blindness and depression, among others. Once neurological symptoms are expressed, ELEM is generally fatal.

Pathological examination typically reveals softened and liquefied cerebral hemispheres as well as muscular melting with accompanying cardiac failure.

In 2001, the U.S. Food & Drug Administration recommended that total fumonisins should not exceed five parts per million in horse feed and that corn should make up no more than 20% of the nonforage portion of the diet.

Corn that has been exposed to optimal growing and harvesting conditions may have very little fumonisin contamination. On the flip side, corn with extensive water and insect damage might have individual kernels that register a fumonisin level of 700 ppm or more. Because moldy kernels tend to break easily, corn screenings are likely to contain high levels of fumonisin and should never be included in horse feed.

TESTING

Feed manufacturers that sell corn directly to horse owners or sell horse feed containing corn should conduct grain testing to ensure that fumonisin levels are well below detrimental levels.

Fumonisin-contaminated corn kernels may or may not reveal contamination on visual appraisal. Infected kernels are often off-colored, exhibiting a salmon or red discoloration on the kernel cap. White streaks radiating from the tops of kernels, called starbursting, is another sign indicative of fusarium infection. Other fungi may cause similar signs, so definitive testing should be conducted.

PHOTOGRAPH | MARK LLEWELLYN

Disease-free corn that is properly harvested and stored is often used as an energy source in horse feeds.



PHOTOGRAPH | MARK LLEWELLYN

Though this ear of corn seems healthy by all outward appearances, feed manufacturers routinely test corn for contaminants before it is used in feeds.

The black light test commonly used to find other mycotoxins in grain does not detect fumonisin. High-performance liquid chromatography screening, available through many universities and commercial laboratories, is routinely used for fumonisin detection.

ALTERNATIVE INGREDIENTS

There are a number of ingredients that can be substituted for corn in horse feeds if a safe supply of corn is unavailable. Which ingredients are selected as replacements will depend on availability, price, and the intended use of the product.

Typically, corn is added to a formula as a source of energy, so the energy density of replacement ingredients is an important consideration. The table lists the most common replacement ingredients for corn in horse feeds.

Oats would be the first choice as a replacement grain for corn. Since oats are lower in nonstructural carbohydrates and higher in neutral detergent fiber, they tend to be about 85% as energy dense as corn. The starch in oats, however, is much more digestible than corn starch, so it does not necessarily require processing.


Direct substitution of oats for corn as 25% of a feed formula will result in a decrease in energy density of about 0.07 Mcal/lb. Adding a small amount of extra vegetable oil (1.6%) will make the formulas isocaloric.

Barley is another cereal grain that is commonly used as a substitute for corn. Barley is closer to having the energy density of corn and can, therefore, be used as a one-to-one replacement for corn in a formula. However, raw barley starch is poorly digested by horses, so it should be steam rolled before being used in horse feed. It should be noted that barley can also be contaminated with fusarium toxins, and barley supplies, particularly from the mid-Atlantic states, should also be tested.

Wheat middlings can also serve as a replacement for corn. Wheat middlings are typically about as energy dense as oats, but they are considerably higher in protein than corn, so it may be necessary to adjust the other protein sources if wheat middlings are the sole replacement ingredient used. Additionally, wheat middlings need to be added to the pelleted portion of a horse formula since they create too many fines when added to a loose mix.

There are also two noncereal replacement ingredients for corn. Sugar beet pulp is a byproduct of the sugar beet industry made by drying the residual pulp after the sugar has been extracted. It contains a high percentage of fermentable fiber, and its digestible energy content is 81% of corn. Beet pulp shreds can be added to a loose mix, but they should be coated with molasses and/or vegetable oil to reduce the possibility of horses choking.

Soy hulls, which are the seed coat of the soybean, are another source of highly fermentable fiber. Soy hulls contain around 74% of the digestible energy found in corn. They should be added to the pelleted portion of a horse feed.

Corn remains a staple ingredient in feed formulations, but alternate energy sources can be used if safe supplies are not available. 

Composition of corn and suitable replacement ingredients for horse feed (as-fed basis)						
	Corn	Oats	Barley	Wheat midds	Beet pulp	Soy hulls
Protein, %	8.4	11.4	11.1	16.5	8.5	12.4
Fat, %	3.9	5.8	2.3	5.7	1.2	3.1
Nonstructural carbohydrate, %	65.8	43.8	53.6	29.5	10.6	4.6
Neutral detergent fiber, %	8.9	24.4	17.2	34.0	37.8	56.3
Calcium, %	0.04	0.12	0.09	0.14	0.84	0.59
Phosphorus, %	0.29	0.37	0.37	0.97	0.07	0.17
Digestible energy, Mcal/lb.	1.59	1.33	1.49	1.36	1.28	1.17
Digestible energy, % of corn	100	84	94	86	81	74





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3910 Delaney Ferry Road
Versailles, KY 40383
Phone: 859-873-1988
Fax: 859-873-3781
Order Department: 800-772-1988
www.ker.com
info@ker.com