

# Moldy corn very risky ingredient for horses

*Horses are particularly sensitive to certain toxins produced in moldy corn. Because of this year's weather conditions, horse feed manufacturers should pay close attention to the quality of their feed supplies. Testing every lot of grain for fumonisin should be mandatory.*

By **JOE D. PAGAN\***

**F**ARMERS across the Midwest have struggled this year to harvest their crops in what has turned out to be an unseasonably wet autumn. These conditions have 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 to fusarium.

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 that is 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 non-forage 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.

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 commonly used for fumonisin detection.

In addition to send-off testing, rapid detection test kits are available for on-site discovery of fusarium toxins. For accurate results, whatever kit is used should be approved by the U.S. Department of Agriculture's Grain Inspection, Packers & Stockyard Administration.

## 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 my 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 supplies, particularly for the mid-Atlantic states, should also be tested.

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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 they are added to a loose mix.

There are also two non-cereal 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.

## Conclusion

Because of this year's weather conditions, horse feed manufacturers should pay close attention to the quality of their corn supplies. Testing every lot of grain for fumonisin should be mandatory. If uncontaminated grain is not available, then corn should either be removed or greatly reduced in all horse feed formulas. ■



### Composition of corn and suitable replacement ingredients for horse feed (on an 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       |
| Non-structural 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        |