

Feeding Flood-Damaged or Sprouted Crops to Livestock

High moisture conditions often lead to crop damage and losses. Some losses are from grain sprouting in the field before harvest. These sprouted grains are considered unacceptable at most elevators. Yet there is a potential option for using these damaged or sprouted grains as livestock feed.

Feed Marketing Regulations

Animal feed products that have been exposed to flood waters or moisture damage are considered adulterated.

Adulterated feed products marketed in commercial channels are regulated by the U.S. Food and Drug Administration (FDA) to ensure food supply safety. Adulterated feed products in commerce may be subject to regulatory action that could include withdrawal from distribution or criminal penalties.

The FDA considers flood water to be unsanitary and considers grains, which have been in contact with flood water, to be unfit for human consumption or animal feed, unless reconditioned (washed and dried at high temperatures). The FDA allows reconditioning in cases where flood water did not remain long and it is known that the water did not contain contaminants. If the grain is to be sold, reconditioning has to be done with the written consent of FDA. For feed on site, producers have three options: dry the grain, feed it immediately to their livestock, or ensile the grain for livestock feed.

Grains exposed to flood waters or moisture damage should not be marketed through conventional marketing channels until reviewed by FDA. Feed prod-

ucts that have been exposed to flood waters should be marketed for feed only after evaluated and deemed safe for use by the FDA. Keep damaged feed crops separate from non-adulterated feeds. Blending adulterated grain with other grain is prohibited.

Pursue testing and approval procedures from FDA before marketing.

Specific testing procedures will be identified by FDA but could include bacteria, mycotoxins, heavy metals, or pesticides. When sampling crops for analysis, it is critical to obtain a representative sample.

On-farm Use of Damaged Feedstuffs

Grain and forage crops raised and intended to be fed on that farm are not subject to these regulations because they are not in commercial distribution. However, before feeding damaged crops to livestock, consider the effects of any feed contaminants on the food products produced by cattle, that is, meat or milk residues. Segregate damaged feed products from nonadulterated feeds. Evaluate the feed crops and feeding areas before feeding to animals. Use appropriate tests to check for chemical or microbiological toxins.

Mycotoxin Risk

Sprouted grains occur in conditions ideal for development of molds. When molds are in grains, they can produce toxins dangerous to livestock. Fumonisin and aflatoxin are two examples of these toxins. Fumonisins, a group of toxins produced mainly in corn and particularly corn



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screenings, are most prevalent when cool weather and high humidity follow hot and dry weather at crop maturity. Aflatoxin production can occur in corn, cottonseed, peanuts, and sorghum. High levels of aflatoxins are associated with above-average temperature and below-average rainfall. Maturing corn undergoing drought and insect stress during prolonged periods of hot weather and drought provides an ideal environment for aflatoxin production.

Mold does not have to be visible for mycotoxins such as aflatoxin to be present. Calves are more susceptible to aflatoxicosis than mature cattle. For young calves, aflatoxin levels exceeding 20 parts per billion

can disrupt normal rumen function, suppress immune function, inhibit protein building, and lead to cancer in calves. Proper crop drying and storage can reduce the potential for mold growth and mycotoxin presence.

The tables below show threshold acceptable levels of these mycotoxins in livestock feeds. Because of the risk of these toxins, the best recommendation is to test any sprouted grain for molds and mycotoxins before feeding to livestock or, when possible, before purchase. Refer to Mississippi State University Extension Service publication 2521, "Anti-quality Factors in Beef Cattle Diets" for a detailed discussion of mycotoxin management on beef cattle operations.

Table 1. Guidance level of fumonisin in livestock feeds¹

Animal Type	Levels in corn and byproducts, ppb (parts per billion)	Levels in total diet, ppb (parts per billion)
Horses, equine	5 ppb, not to exceed 20% of total diet	1 ppb
Breeding ruminants	30 ppb, not to exceed 50% of total diet	15 ppb
Ruminants greater than 3 months, raised for slaughter	60 ppb, not to exceed 50% of total diet	30 ppb

¹Adapted from FDA Guidance Levels

Table 2. Action levels for aflatoxins in livestock feeds¹

Animal Type	Aflatoxin Level, ppb (parts per billion)
Finishing beef cattle, beef cattle	300 ppb
Finishing swine (greater than 100 lbs)	200 ppb
Breeding cattle, swine	100 ppb
Immature animals	20 ppb
Unknown use	20 ppb

¹Adapted from FDA Guidance Levels

General Feeding Management

It may be tempting to use damaged crops because of the attractiveness of a discounted price, but a feed analysis should be conducted to determine the exact quality of the nutrients available. Additionally, in designing supplement programs it is important to know the nutrient content of feeds used. Therefore,

a nutrient analysis (feed test) is of the utmost importance. This allows proper diet formulation. Remember to adjust amounts fed of wet crops for moisture content. There appears to be very little negative effect of feeding sprouted grains on livestock performance.



Figure 1. Corn stored wet in a bulk bag and beginning to sprout on top. A quick view does not show much damage.



Figure 2. Corn from the same bag as in Figure 1. Mold growth and damage is apparent on corn from deeper within the bag.



Figure 3. Mold spores are apparent on this flood-damaged corn.

Feeding Management: Corn

A thorough inspection and analysis of the grain product should be conducted before using damaged corn as a feed (Figures 1 to 3). Uncontaminated soaked corn can be used as a cattle feed if fed immediately, because spoilage can occur within a day or two. The extent of damage to corn, can result in an alteration of its nutrient profile, or growth and development of mycotoxins because mold growth. It is important to understand the extent of the damage. Therefore, it is imperative that a nutrient analysis and, if moisture damage is severe enough to cause molding, a mycotoxin screening of the product be obtained.

If corn has been flood damaged and subjected to flood waters, the grain should be discarded because of the high potential for contamination (natural and chemical) from floodwaters. If corn grain is simply wet and not damaged, there are several options for use. 1) Drying corn can maintain its quality. Carefully remove the undamaged grain from the wet damaged corn. 2) Feed wet corn immediately to livestock. Use the wet corn in a manner similar to dry corn. However, some adjustments to the quantity fed need to be made for moisture content. Spoilage will occur rather rapidly. There is probably a 3- to 5-day window in which to use the grain. 3) Ensile wet corn for later feeding to livestock.

Storing wet corn can lead to spoilage and excessive heat production. In addition to losses associated with mold growth and spoilage, under the proper circumstances, this excess heat may cause a Maillard Reaction to occur. When this happens, protein within the corn grain undergoes a chemical process that makes it indigestible.

Corn that is simply sprouting will not usually affect animal performance. Cattle fed sprouted grains

have similar performance to their counterparts fed undamaged grains. However, the environmental conditions that favor sprouting of the mature seed also favor mold growth. In the case of severely damaged corn, conduct analyses to determine nutrient content and presence and level (if present) of mycotoxins.

Feeding Management: Sorghum (Milo)

The steps in properly feeding damaged milo are similar to feeding damaged corn. Inspect the feed before use. If mold or damage is present, obtain a sample for nutrient analysis and mycotoxin screening (Figure 4). As with corn, sprouted milo can be fed to cattle without any adverse affect. However, the conditions that favor sprouting can favor mold growth. Storage of wet milo can also lead to spoilage and potential nutrient indigestibility.



Figure 4. Milo blended with damaged milo and soybeans. Note the black-colored milo grains indicative of heat damage which renders the nutrients in those grains indigestible.

Feeding Management: Whole Soybeans

Raw whole soybeans contain 40 percent crude protein and 20 percent fat on a dry matter basis. However, damage to soybeans may decrease their nutrient content. Obtain a nutrient analysis and an aflatoxin test

before purchasing or feeding any damaged soybeans (Figures 5 and 6). The nutrient analysis will help determine feeding quality and allow for appropriate diet formulation.



Figure 5. Damaged soybeans from a farm in South Central Mississippi. Note the damage on the grains and several darker grains that are almost black. Those indicate heat damage that makes the nutrients in the soybeans essentially indigestible.



Figure 6. Damaged soybeans that were picked dry and then were water damaged. Note the mold growth on the outside of the soybeans.

Because of the high fat content (20 percent), whole soybeans should be limit fed at a level so the total dietary fat level does not exceed 6 percent for mature cattle or 4 percent for growing cattle. High fat levels can lead to reduced digestibility of forages and other feedstuffs; interfere with calcium, magnesium, and vitamin A absorption; cause fluctuations in feed intake; and result in scours (diarrhea). Because of fat intake concerns, do not feed whole soybeans free choice or at levels that exceed total dietary fat recommendations. Grazing soybean stubble containing whole beans can result in overconsumption and is not recommended. Wet, whole soybeans can be fed to mature cattle if the soybeans are limited to 10 to 12 percent of the ration dry matter.

Grinding raw soybeans can increase their digestibility. But grinding soybeans decreases their shelf life, because the fat inside the beans becomes exposed to the elements and can become rancid. Feed ground soybeans within 3 weeks following processing and sooner during humid conditions.

Unprocessed (uncooked) soybeans have several enzymes that can make them particularly challenging to incorporate them into cattle rations. The first is a trypsin-inhibiting enzyme, which is important to nonruminants/monogastrics (horses, swine) or preruminants (young calves). This enzyme can inhibit protein digestion. Therefore, it is not recommended to feed raw soybeans to monogastrics or young preruminant calves (nursing calves or calves less than 300 pounds). If raw soybeans are offered to cows with calves, there is a risk that the calves may consume these soybeans.

Another concern is that raw soybeans contain urease. Urease breaks urea down into ammonia. This is important if cattle are receiving a supplement or feed that contains urea (nonprotein nitrogen, NPN). The increased activity of urease in raw soybeans can result in a more rapid breakdown of urea into ammonia within the rumen, potentially leading to ammonia toxicity and cattle death. Be aware of all ingredients in feeds provided to cattle. Many commercially available protein tubs and blocks contain urea, which can potentially be fatal to cattle when fed with raw soybeans. Range cubes may also contain urea. Do not feed any combination of urea-containing products and raw soybeans to cattle.

Feeding Management: Cottonseed

Little data are available regarding the use of sprouted whole cottonseed as a feedstuff for livestock. As with the aforementioned grains, evaluate water damaged whole cottonseed for nutrient and mycotoxin content. Do not assume that feeding sprouted whole cottonseed will not affect animal performance. When germination (spouting) begins, the concentrations of free fatty acids (FFA) in whole cottonseed increase. Free fatty acids, when fed at a high enough level, can interfere with ruminal digestion and affect intake. Because of the potential of the increased levels of FFA in a product that already has a high fat content (approximately 18 percent fat in undamaged, whole cottonseed), exercise care in feeding this product to cattle so as not to over-feed fat and FFA. Use similar guidelines to feeding whole soybeans with sprouted whole cottonseed. Do not exceed dietary fat levels of 6 percent for mature cattle or 4 percent for growing cattle. Higher fat content may also lead to rancidity more rapidly, which, in turn, may affect animals' acceptance of the feed.

Implications

Damaged crop availability increases during periods of poor harvesting conditions, making these crops available to many cattle producers often at discounted prices. A risk is associated with feeding damaged crops to livestock. The risk may be small, in some cases, but there is still a risk that some crops have been exposed to unknown contaminants or may have developed mycotoxins. Feeding adulterated feed products could lead to unwanted residues in meat or milk that could have additional regulatory consequences.

The ideal situation is to not harvest crops that have come in contact with flood waters or other moisture damage. However, with careful testing and management, it may be possible to minimize the risks and potential liability associated with feeding and using damaged crops. Damaged crops can be successfully used in beef cattle diets only if feeding regulations and guidelines are followed. Damaged crops may be offered at bargain prices, but it is important to understand the potential risks associated with feeding them to livestock.

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Grain samples for photos courtesy of Lance Newman and Chris Daves. Photos courtesy of Chris Daves and Daniel Rivera.



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