
Drought-Related Issues in Forage, Silage and Baleage

The extreme drought of 2018 in the Midwest region has forced livestock producers to be concerned with drought effects such as high levels of nitrates in forage and drought-damaged crops for silage and baleage. Many producers are now searching for alternative feeding options for livestock. In addition to safety and herd health issues, these factors affect the business decisions for each operation.

In response to producers' concerns, University of Missouri Extension has developed this list of producers' questions answered by extension crop and forage specialists.

Drought issues related to feeding livestock

Nitrates

What amount of nitrogen or manure applied to hay is likely to cause a nitrate toxicity problem?

The more nitrogen supplied to the crop, the more likely nitrate toxicity will occur.

Are the nitrates in forage substantially higher in the morning than in the afternoon?

No.

If we get some rain, what happens to nitrate levels in corn?

Initially, nitrate levels will increase for a few days following a rain. However, nitrate levels will decrease to normal levels about 10 days after a rain if the crop begins to grow again.

After doing a nitrate quick test of feed sources, when should a farmer consider sending in a sample for a quantitative test?

If a nitrate quick test shows any reaction at all, a quantitative test of the feed should be done before feeding it to livestock.

Silage and baling

How does feeding value of drought-damaged corn silage compare to that of traditional corn silage?

Because drought-damaged corn usually has less grain, its feeding value is lower than corn produced in a normal season. However, the ratio of grain to fodder in the silage does not change as much as is often anticipated. Typically, the feeding value is about 85 percent of that of normal corn silage feeding value.

Will nitrate levels in corn silage drop during the ensiling process?

Yes, typically nitrate levels drop 25–50 percent during the ensiling process if the silage ferments well.

Do nitrate levels in bagged corn silage get lower like nitrate levels of silage in a pit?

Ensiling will lower nitrates, but how it is packaged (pit, bag, baleage) makes no difference.

Can drought-damaged corn be made into baleage (large round-bale silage)?

Yes, but it takes a bit of extra management. Be sure that the bales are compacted well, net wrapped (which keeps the stalks from poking through as much) and then wrapped with plastic to a final thickness of 6 to 8 mil. Corn should be baled at moisture content of 50 to 60 percent.

Will chopping silage at a higher level than usual, such as one foot high, lower the nitrate danger enough to make it safe for feeding?

Not necessarily. Nitrate concentrations are higher in the lower parts of the plant. Increasing cutting height can help lower the concentrations in the silage, but it does not guarantee that the nitrate levels in the feed will be safe.

Forages

What can I plant into dead or dormant cool-season perennial grasses that could provide winter grazing IF there is no rain in time to simulate a fall grass growth before the late October growing decline?

If it doesn't rain until late October, there is nothing you can plant for winter grazing this year. If the drought kills a pasture, you could plant winter wheat or rye in late summer (early September), providing there is sufficient autumn moisture for establishment and growth.

What are some fall grazing forage options to plant if the drought "breaks" between now and mid-August?

See the previous answer. Winter annuals are the best.

My hay meadow received a rain shower last week. A lot of Johnsongrass has started to regrow in the meadow. If I cut it, will the nitrates persist in the hay?

Yes. The nitrates will not degrade unless you ensile the forage.

At what level of applied nitrogen or animal manure should I be concerned about the potential nitrate level in hay? Will it be the same issue in a pasture?

The levels are the same for pasture and hay. Any concentration above 0.25 percent can begin to cause problems, with concentrations above 1 percent causing the most serious problems. See MU Extension publication G4661, *Warm-Season Annual Forage Crops*, for more information: <https://extension.missouri.edu/p/g4661>.

Will nitrate levels go down after hay is stored for a specific period of time?

No.

What is the nutritional value of grasses or weeds — Switchgrass and foxtail in particular — that are still green at this time of year?

The nutritive value of forage is related to its stage of maturity. Typically, switchgrass and the summer annual weeds such as foxtail, barnyardgrass, goosegrass and crabgrass are reproductive this time of year; as such, they are "stemmy" and have low digestibility. But they can provide some roughage.

What are some alternatives for feeding hay?

- **Corn silage**

Among alternative feedstuffs, high-nitrate corn silage is more readily available and offers the greatest energy content with the benefit of nitrate reduction. Corn silage necessitates that you modify your storage and feeding systems due to the wet nature of feed. If you make corn silage in bale form, you can use existing feeding and storage systems; however, waste will be higher than normal silage systems due to stalk refusal. If excessive dry-down occurred before the traditional corn silage harvest, baling wet stalks can lengthen the harvest window. Field reports indicate ear losses can be high with roller conditioners.

- **Corn stalks**

Baling dry corn stalks after harvest can ensure accurate corn harvest estimates and increased nitrate-reduction time. Corn stalk grazing can limit field losses and waste hauling from feeding areas. You will

need to add protein supplements to corn stalks. Corn stalk bales can have up to 45 percent total digestible nutrients (TDN) and 6 percent crude protein (CP), which is greater than other straw alternatives. However, producers should expect greater waste from baled corn stalks, because cows will leave cobs and thick stalks behind after eating leaves and husks. Corn stalk fields can be stocked to graze at a rate of 2 acres per cow, which will provide 60 days of grazing. Expect cows to gain weight the first month, then as the higher quality plant parts are used up, provide 1 pound of supplemental crude protein per cow per day to improve digestibility of the lower quality components. Chemical treatments such as calcium oxide (CaO) or ammoniation can improve forage quality and digestibility. Refer to the article *Digestibility of Crop Residues After Chemical Treatment and Anaerobic Storage* from University of Nebraska-Lincoln for more information on CaO treatment: <http://digitalcommons.unl.edu/animalscinbcr/633>.

- **Soybean baleage**

Soybean baleage will help maintain leaves on the plant during harvest. Harvesting dry soybean hay will result in high leaf losses and reduced forage quality. Immature pods contribute to the energy content of soybean hay; and pod formation will be variable. Therefore, you should perform forage testing to determine feeding recommendations. A delayed harvest of soybeans without pods will result in reduced forage quality due to advancing maturity. Observe herbicide grazing and haying restrictions

- **Poultry litter**

In areas where broilers or turkeys are fed, you can feed poultry litter to extend hay supply and reduce supplemental protein needs. Litter must be stacked and allowed to heat prior to feeding; but after storage it can be used as a supplement to hay or as a substitute. See Alabama Cooperative Extension System's publication, *Feeding Broiler Litter to Beef Cattle*: <http://aces.edu/pubs/docs/A/ANR-0557/ANR-0557.pdf>.

Traditional corn- and soybean-based byproduct feeds likely will be more expensive and in short supply. Consider alternatives such as wheat, peanut and cotton products. Wheat straw can be chemically treated similar to corn stalks. Gin trash and peanut hay offer alternative roughage sources. Remember, peanut and cotton hulls serve primarily as fillers and have low energy value, so price your supplements based on nutrient values rather than price per ton. If the local corn crop develops aflatoxin later in the fall, beef producers may buy infected corn at a discount.

Planting winter annuals such as oats, cereal rye and annual ryegrass in late August may offer some relief; however, you will need a timely rain to justify additional input costs. Be wary of herbicide carryover due to drought conditions. Use MU Extension's byproduct feed page to shop for alternative feed ingredients: <http://agebb.missouri.edu/dairy/byprod/listing.php>.

Can feed additives help reduce nitrate feeding risk?

Ensiling is the best option to use for high-nitrate feeds. Over time, in cattle, sheep, goats and buffalo, rumen microbes will develop increasing tolerance to nitrates. The best feed additive is a low-nitrate feedstuff, which will dilute nitrates.

What are recommendations for grazing corn?

Avoid grazing corn seven to 10 days following a rain, because nitrates will increase. Waste will be high with grazing. Waste may be advantageous since most products left in the field will be high-nitrate stalks. Limit access to new and old stalks to reduce waste and regrazing stalks, respectively

I have enough hay, but I also have access to corn silage. Should I chop the silage?

Use local distressed crops if silage fits your feeding system; then consider marketing excess hay as an alternative enterprise. Conversely, use silage to retain calves and move to a different marketing window, or dry lot cows or calves on a custom basis.

When are nitrate levels in forage too high for feeding forage by itself or mixed with hay?

Nitrate levels in feed can be classified into four usage categories: safe, caution, danger and toxic. Feed in the safe category can be fed to any class of livestock. In the caution and danger categories, limited amounts of the feed can be used for nonreproductive livestock. Feed in the toxic category should not be fed to any class of animals in any amounts.

Table 1. How Much Nitrate Is Too Much?

NO_3-N (ppm)	NO_3 (ppm)	Category	Recommendation
0 to 550	0 to 2,500	Safe	Forage is generally safe to feed to all classes of livestock.
550 to 1,100	2,500 to 5,000	Caution	Forage with the nitrate (NO_3) content can cause a problem in pregnant and young animals. Do not feed forage with nitrate levels this high in combination with nonprotein nitrogen supplements; and limit forage with NO_3 levels this high to one-half of total ration.
1,100 to 3,400	5,000 to 15,000	Danger: Toxic	Limit forage with the NO_3 level to one-fourth of total ration. Should supplement forage of this type with energy minerals and Vitamin A.
More than 3,400	More than 15,000	Extremely toxic	Forage with this NO_3 level or higher is toxic and should not be fed under any circumstances.

Prepared by Rob Kallenbach, MU Extension forage production and management specialist

Are high nitrate levels a bigger concern in specific classes of livestock?

As indicated in Table 1, young and pregnant animals are most susceptible to nitrate toxicity. Usually seven to 10 days after exposure to high nitrate feeds, pregnant animals will abort due to lack of fetal oxygen. Young animals are susceptible to nitrate toxicosis because their fetal hemoglobin has an increased affinity for absorbing nitrates. As with many other nutritional disorders, aged or poorly conditioned animals are at increased risk compared to well-fed or heavily conditioned animals

What are the keys to weaning calves early?

Work with your local veterinarian to develop a vaccine plan. In general, plan to vaccinate for blackleg and respiratory diseases three to four weeks before weaning. Revaccinate at weaning. Because early weaned calves have a low feed intake, be sure to feed them a nutrient-dense diet. You may need to increase the nutrient concentration in their feed to allow adequate energy and protein intake. Make sure your facilities fit smaller calves by checking the calves' ability to reach water and feed. Offer high-quality hay in feed bunks where feed is offered. Until calves are bawled-out and bunk-broke, feed them multiple times a day to encourage intake and check for sick animals.

What steps should I should take to extend hay supply?

Early weaning reduces cow nutrient requirements by 40 percent. This saves a day's worth of feed for a cow for every 2.5 days a calf is weaned. This savings extends forage supplies while allowing cows greater time to build body condition before winter. After early weaning and 90 days following the start of the 60-day breeding season, pregnancy diagnose cows and sort cows into the following management groups to prioritize culling order and forage resources.

- A. Age, disposition, condition or terminal-age culls
- B. Young, old, thin open cows
- C. Adequately conditioned open cows
- D. Low-producing or short-bred cows
- E. Young, old, thin pregnant cows
- F. Adequately conditioned pregnant cows

By prioritizing the forage supply and culling early, you will enable productive cows to use the available resources efficiently. Consider limit-feeding cows to increase efficiency. Limit-feeding will reduce waste and

focus resources on high-nutrient demand groups. As hay prices increase, the cost of waste and inefficiency also will increase. You can increase hay supplies by 25 to 50 percent, depending on current systems, by reducing hay waste through improved storage and feeding practices. If you are feeding cows daily supplements, consider adding monensin to the supplement. Ionophores have shown 10 percent reduction in maintenance energy requirements; and monensin, the only ionophore approved for beef cows, increased energy content of poor quality hay by 15 percent in recent research at Oklahoma State University.

Drought considerations for fall planting

The drought has ruined my corn and soybean crops. If I plant winter wheat or a forage grass this fall, should I be concerned with herbicide carryover?

Extreme drought does increase the risk of herbicide carryover to fall-seeded crops. While it is difficult to predict exactly when or where herbicide carryover injury might occur, the following factors influence the likelihood of herbicide carryover:

- Type of herbicide applied
- Rate of herbicide applied
- Time during the season that the herbicide was applied
- Soil pH
- Most importantly, the amount of rainfall received since the time of the initial herbicide application

For more information about herbicide carryover, including tables showing the required rotational intervals between application of corn and soybean herbicides and planting of winter wheat or forage grasses, see the article *Consider Herbicide Carryover Potential Before Planting Wheat or Forage Grasses This Fall* by University of Missouri's Integrated Pest Management program: <https://ipm.missouri.edu/IPCM/2012/8/Consider-Herbicide-Carryover-Potential-before-Planting-Wheat-or-Forage-Grasses-this-Fall>.

Where will we stand on available phosphorus and potassium in crop ground if crops didn't utilize applied nutrients? Will I be able to reduce inputs next year?

If yields are water-limited this year, phosphorus (P) and potassium (K) removal will be reduced. This will affect soil test levels. **For fields with new soil tests next year**, recommendations can be followed, as is.

Soil tests that were taken under drought conditions often give abnormal results for potassium. It is best to wait until soil moisture is somewhat replenished before taking soil samples.

For fields with previous soil tests, or for fields where soil tests are not part of phosphorus and potassium rate decisions, a credit can be given for phosphorus and potassium not removed this year; and rates can be reduced by the amount of this credit, with no risk of yield loss. For example, a phosphorus credit would be (projected P removal at yield goal) minus (actual P removal at actual yield). The phosphorus removal is calculated as (Yield) times (Grain P concentration). Grain P and K concentrations can be found on pages 12 and 20, respectively, of the University of Missouri publication *Soil Test Interpretations and Recommendations Handbook*: <http://aes.missouri.edu/pfcs/soiltest.pdf>.

How much of the nitrogen applied to my corn crop will be available for fall-seeded small grains?

Plenty will be available in the fall. But small grains don't need much nitrogen (N) in the fall. The real question is how much will be available for small grains next spring. This will depend on winter and spring weather. Wet weather may lead to loss of nitrogen applied to, but not used by, corn. If winter and spring are not unusually wet, and corn yields were greatly reduced, it may be possible in some cases to get full yield of small grains without applying any additional nitrogen fertilizer.

One way to assess nitrogen availability from a droughted corn crop to a following small grain is to flag a small part of the field and hand-apply nitrogen to the small grain right at green-up in early spring. Check appearance of the small grain three weeks later — if it's hard to see a difference in appearance where the green-up nitrogen was applied, it is likely that no additional nitrogen is needed.

Is it possible to capture nitrogen for winter small grains such as wheat, rye and oats?

Winter small grains will take up no more than 20 pounds of nitrogen per acre in the fall. Most corn fields will have a lot more than this available, due to low yield and low nitrogen uptake. Most soybean fields should have plenty, as well.

The amount of nitrogen from this year that will be available for small grains next spring depends on winter and spring weather. Wet weather may lead to loss of nitrogen applied to, but not used by, corn. If winter and spring are not unusually wet and corn yields were greatly reduced, it may be possible in some cases to get full yield of small grains without applying any additional nitrogen fertilizer.

See the answer to the previous question for a way to assess nitrogen availability from a droughted corn crop.

Can cover crops take up nitrogen this fall and release it for use in a spring planted crop?

Cover crops can take up, or scavenge, nitrogen this fall, but in limited amounts — possibly 20 pounds of nitrogen per acre. They can take up additional nitrogen in spring prior to killing, but they can't be counted on to release the nitrogen in time for a spring-planted crop to benefit. The accumulated carbon and nitrogen will benefit the soil by producing additional organic matter; but fertilizer rates for a following spring crop should not be reduced.

Drought questions affecting farm business decisions

Should I sell livestock or buy hay?

Cows without pasture will consume half a ton of hay per month. Purchased grass hay will cost between \$100 and \$200 per ton from now until the spring of 2019. Inventory your hay and cow numbers to estimate the cost of carrying cows until next spring. Most producers will find heavy culling justified or unavoidable. Sell cows and buy needed forage as soon as possible to avoid markets where prices are driven by glut and scarcity.

What are the tax liabilities if I sell cattle?

If you sell breeding cattle in excess of normal sales due to drought, you do not have to pay the income tax on sales if the cattle are replaced within two years under IRS Code Section 1003(e).

Will harvesting my corn for silage impact crop insurance payments I receive?

Crop insurance indemnities are not affected by harvesting corn for silage. In fact, harvesting damaged corn as silage offers additional revenue to the farmer without reducing revenue from insurance. Farmers who planted corn for grain but now want to harvest it as silage can do so after their insurance adjuster gives them permission. The adjuster will visit the field under consideration and give an estimate of yield that insurance will pay on or mark a strip of the field to be left until harvest. This strip, when harvested, will represent the yields of the entire field. Indemnities will be paid based on this yield.

Summary: (1) Never do anything before you contact your insurance company and receive their permission to harvest as silage; and (2) harvesting corn as silage will not reduce your insurance indemnity.

For insurance, how do I estimate potential yield with the in-field variability across the board this year?

Estimating yield for insurance purposes is the responsibility and sole prerogative of the insurance company. They are obligated to estimate yields according to best scientific methods. But if you disagree with their estimate of yield, your option is to let the crop mature until harvest. The time it would take to challenge an insurance adjuster's estimate of yield would likely drag on beyond the appropriate time to harvest as silage.

What is the value of drought-stressed corn made into silage?

Drought-stressed corn silage generally has a feeding value of 85 to 95 percent of normal corn silage if a check of nitrate levels indicates it is safe to feed. The cost of other feeds is reflected in MU Extension's weekly update of the latest relative feeding value of good corn silage going into a beef ration: <http://agebb.missouri.edu/dairy/byprod/energygain.php>.

What is corn silage worth relative to corn?

Pricing standard 35 percent dry matter drought-stressed corn silage may be roughly based on the price of a bushel of corn:

- **If standing in the field**, silage is worth six times the estimated harvest-time net price of corn per bushel. Example: $6 \times \$3.75$ per bushel = \$22.50 per ton.
- **If chopped, delivered and packed in silo**, it is worth eight times the estimated harvest-time net price of corn per bushel. Example: $8 \times \$3.75$ per bushel = \$30 per ton.
- **If dropped in the bunk in front of an animal**, it is worth 10 times the estimated harvest-time price of corn per bushel. Example: $10 \times \$3.75$ per bushel = \$37.50 per ton.

Moisture levels, yields and shrink can differ dramatically from expectations. For tools to arrive at situation-specific prices, see <http://dairy.missouri.edu/feed>.

How do I estimate corn silage yield?

If little or no grain is expected, a rough preharvest estimate of yield is that 1 ton of silage per acre can be obtained for each foot of plant height, excluding the tassel.

How much corn grain should there be to justify combining the corn instead of chopping it?

The easy answer is to divide the cost of harvest by the market price. For example, if harvesting 1 acre of corn costs \$30 and the market price of corn grain is \$3.75 then a yield of 8 bushels per acre would pay for harvest.

However, corn yields of less than 30 bushels per acre may be difficult to harvest. A bushel of corn with normal-sized seeds contains about 73,000 kernels. If you assume a stand of 26,000 plants per acre and that each plant produces one ear, then it takes 2.8 kernels per ear to produce a bushel. So, a yield of 4 bushels per acre means the average kernel number per ear is 11. Even a yield of 30 bushels per acre translates into average ear size of 84 kernels — much smaller than the normal 600. Combines were not designed to efficiently harvest and shell such small ears, which are easily lost through the gathering mechanisms. Oddly shaped cobs and kernels may not flow normally through the rest of the combine. Kernels from sparsely populated ears can be larger than normal or much smaller than normal. If drought is relieved soon, then kernels will expand greater than normal and their shapes will be round because they do not have neighboring kernels to restrain their growth. If drought continues through seed filling, then seeds will remain small. Either of these abnormal kernels sizes may not thrash well from the cob. Smaller-than-normal kernels will have low test weights because they will contain relatively less starch and more cellulose.

So, low yield corn is difficult to combine, and increased harvest loss needs to be included in any calculations. Combine operators will need to pay special attention to machine settings. Unfortunately, wide variations for yield among areas in fields may make proper setting of combines difficult.

MU Extension contributors:

Eric Bailey, beef extension specialist
Joe Horner, agricultural economics specialist
Robert Kallenbach, forage production and management specialist
Ray Massey, agricultural economics specialist
Craig Roberts, agronomy specialist
Peter Scharf, agronomy specialist
William Wiebold, agronomy specialist

