D's Notes
11/02/20

Fall soil testing of hay fields and pastures

Soil testing can be done in either spring or fall on hay fields and pasture. Given a choice, fall would be the preferred time because it allows more time for any needed lime applications to have an effect before the main growing season begins, and it gives the producer some flexibility for planning nutrient applications.

Soil sampling on a regular basis (every 3 – 4 years) can keep you from applying excessive and unnecessary amounts of fertilizer or manure, and can increase yields by revealing exactly which soil nutrients are too low for optimum productivity. By doing this practice properly, producers can save money and reduce environmental impacts.

Tips for collecting a representative soil sample

To take accurate soil samples, it is best to use a soil probe. You can borrow a probe from many county extension or NRCS offices. A shovel or spade can be used, but make sure to dig a hole first and then take a nice even slice to the correct depth. A shovel or spade that angles to a point at the bottom can easily result in misleading soil test results because the sample is biased by having more soil from the surface and less from lower depths.

When taking soil samples, it is important to have a representative composite soil sample from the field by combining several soil cores and mixing thoroughly. Ideally, one composite soil sample should represent a uniform and treatable area and should not exceed 40 acres, and for more variable fields, no more than 10 acres. On these areas, take 15 to 20 cores or subsamples to make up your representative composite sample. If the field has areas where different forages or crops have been grown, or has different soil types, then soil sampling from these areas should be done separately.

Sampling depth for pastures and hayfields should be 3 to 4 inches for pH evaluation. For phosphorus and potassium, a 6-inch depth is preferred when submitting samples to the K-State Soil Testing Laboratory since that is the depth we have used to calibrate recommendations.

For more information on soil sampling contact the Hodgeman County Extension Office at 620-357-8321.

Prussic acid in sorghum following a hard freeze

Prussic acid is also known as hydrocyanic acid or hydrogen cyanide (HCN). Ingesting plants that have produced excess cyanide causes prussic acid poisoning. Sorghums, sudangrass, sorghum–sudangrass crosses, and closely related species are most commonly associated with prussic acid poisoning.

Appropriate management of these forages combined with sample analysis can minimize poisoning risks and allow safe use of these forages. Delaying grazing until minimum plant heights are achieved or until injured or stressed plants have had adequate time to recover or by proper ensiling or conditioning and drying hay can reduce prussic acid concentrations.

Once the prussic acid precursors are eaten, the rumen is an excellent medium for formation of cyanide, which is absorbed directly into the bloodstream and binds to enzymes in the cell. This cyanide complex prevents blood hemoglobin from transferring oxygen to individual body cells, and the animal dies from asphyxiation.

Prussic acid poisoning is related to the amount of forage consumed, the rate of consumption, and the animal's physiological condition, but HCN levels in forages exceeding 200 parts per million on a wet weight (as is) basis are dangerous. On a dry weight basis, forages with more than 500 ppm HCN should be considered potentially toxic (Table 1).

FORAGE FACTS MF3040 Forage Toxicity Table 1.
Level of prussic acid in forage (dry matter basis) and potential effect on animals.

ppm HCN	*Effect on animals*
0–500	Generally safe; should not cause toxicity.
500–1,000	Potentially toxic; should not be the only source of feed.
1,000 and above	Dangerous to cattle and usually will cause death.

Prussic acid acts rapidly, often killing animals within minutes. Symptoms of poisoning include increased pulse rate and respiration, excessive salivation and foaming at the mouth, blue coloration of the lining of the mouth, difficult breathing, staggering, convulsions, and collapse. Death from respiratory paralysis follows shortly. The clinical signs of prussic acid poisoning are similar to nitrate toxicity, but animals with cyanide poisoning have bright red blood that clots slowly, whereas animals poisoned with nitrate have dark, chocolate-colored blood. The smell of bitter almonds is often detected in animals poisoned with cyanide. Because it occurs quickly, the symptoms are usually observed too late for effective treatment.

In the absence of a veterinarian, and if there is little doubt about the diagnosis, the animal can be treated with an injection of sodium nitrate and sodium thiosulfate. Sodium nitrate releases the cyanide from the cell, which binds with the sodium thiosulfate to form a nontoxic complex that is excreted. Animals still alive one to two hours after the onset of visible signs usually recover.

Prussic Acid Concentration Factors Plant Species. Crop species most commonly involved with prussic acid poisoning are forage and grain sorghums, Johnsongrass, shattercane, sudangrass, and sorghum-sudangrass crosses. Potential cyanide production varies widely among varieties and hybrids of most summer annual forages. Grain sorghum

and forage sorghum tend to be more toxic than sudangrass or sorghum-sudangrass. Hybrid pearl millet and foxtail millet are generally considered to not have high prussic acid concentrations. Indiangrass, flax, chokecherry, black cherry, elderberry, and some varieties of white clover and birdsfoot trefoil also can cause prussic acid poisoning.

Avoiding Prussic Acid Poisoning

- Avoid grazing or green chopping young sorghum or sudangrass plants or new regrowth.
- Do not allow hungry cattle to graze where prussic acid may be a problem.
- Feed hay or grain before releasing cattle to pasture to slow intake and reduce the poisoning risk.
- Do not allow animals to graze potentially troublesome plants after a light frost or after rain has ended a summer drought.
- Hay or ensile plants high in cyanide to reduce toxin levels.
- Have representative samples of any suspect forage analyzed before feeding.

For more information look up *Prussic Acid Poisoning MF 3040* publication at. https://bookstore.ksre.ksu.edu/pubs/MF3040.pdf or contact the Hodgeman County Extension Office at 620-357-8321.

Knotweed Control

Knotweed thrives in compacted soils, so a thorough aeration is the first step in control. This weed will not compete in a healthy lawn. Chemically, there are two options. Knotweed is an annual that germinates in late February or early March, so a preemergence herbicide can be used in the late fall (about now). Pendimethalin (Scotts Halts), Surflan (Weed Impede), Barricade, Dimension and XL are labeled for knotweed. (Note: Pendimethalin, Barricade and Dimension can be used on all Kansas turfgrasses, while Surflan and XL can only be used on tall fescue and warm-season grasses such as buffalograss, zoysiagrass and bermuda).

The other option is to use a combination postemergence product such as Trimec, Weed-Out, Weed-B-Gon or Weed Free Zone after the knotweed has emerged in the spring but is still young.

If spring seeding of the lawn is planned, your options are more limited. Trimec and other combination postemergence herbicides require a month before overseeding to thicken up your lawn. Obviously, don't use a preemergence herbicide if you are trying to get new seed established. For homeowners seeding in the spring, tilling will control knotweed adequately without using a herbicide. If seeding without tilling (e.g., overseeding using a slicer-seeder), then use a combination product such as one mentioned above just after the knotweed comes up in the spring, and be sure to wait at least a month before seeding. (Ward Upham)

Keep Compost Pile Moist

This is the time of year when there are lots of materials available to compost. Remember that the compost needs to be kept moist so that the bacteria and fungi can break down the raw materials. If you haven't received rain recently, you may need to wet down the pile. Use a sprinkler to soak through the pile to the center. Allow the pile to drain. The goal is for the pile to remain moist; not waterlogged. Edges will dry out the quickest and may need a light sprinkling from time to time.

If you are interested in composting but don't know how it is done, see our video at http://tinyurl.com/jn6yppo.

We also have a series of publications on composting that can be accessed at http://hnr.k-state.edu/extension/publications/horticulture-practices.html (Ward Upham)

Begin Rabbit Protection Now

Rabbits may begin to nibble on newly planted trees and shrubs through the winter. Protect your investment with at least 2-foot-tall cylinders of 1-inch-mesh, chicken wire, or similar barrier. Remove the barrier in the spring or it can be left in place for a time. Just remember to remove it before it starts to constrict the trunk.

Other control methods include plastic tree wraps and liquid rabbit repellents sprayed on the plants. Repellents will need to be reapplied each time it rains. (Ward Upham)

Garden Hoes

There are a number of different designs for garden hoes. My favorite three are the traditional, circular and scuffle. The traditional hoe is used to chop weeds or to lightly scrape the soil surface to kill weeds that are just emerging. Even though it is the most popular garden hoe, it is the one I use the least.

The scuffle hoe is the most used hoe I own. It covers a lot of ground quickly and kills weeds without disturbing the soil much. Because little new soil is exposed, it is less likely to bring up weed seed that will then germinate. This type of hoe can be more difficult to find than the traditional hoe and a mail-order company may be needed if your local garden center doesn't handle them. There is a company in Kansas that makes these hoes in several different widths as well as a number of other types. All are made out of recycled disc blades. That company is Prohoe Manufacturing, LLC (https://www.prohoe.com/) out of Munden, Kansas.

The circular hoe is more specialized. It features a circular "blade" in which only the bottom is sharpened. This allows you to hoe very close to existing plants without harming them as the sides of the circle are dull. This one was invented by an Oregon Extension Master Gardener in the late nineties. Though short-handled ones are relatively easy to find, the long-handled types are more difficult. As a matter of fact, the only source

I could find was from Red Pig Toos. See https://www.redpigtools.com/Circular-Hoe-Long-Handle_p_1405.html .

Though these three types are my favorite, don't be afraid to try other types to see how they work for you. (Ward Upham)

Test Your Forages

Testing your forage is very helpful in understanding its market value and nutrients when formulating rations for you animals. Without testing your forage, you can only guess its true nutrient value. With a test, you are able to make sure you are not overfeeding or underfeeding your herd. This will help you create a more productive feeding plan.

ALSO, DO NOT FORGET TO TEST FOR NITRATES IF THERE IS A QUESTION.

Here is a brief summary of the Forage Sampling Procedures and Equipment MF 3177, https://bookstore.ksre.ksu.edu/pubs/MF3177.pdf.

Forage sampling is used to gather information about hay or silage to determine its market value and ration formulation for livestock. To be useful, the sample must be representative of a particular lot, capturing properties of hundreds of thousands of pounds of a wide variety of plant material in a single, thumbnail-sized sample. The sample should accurately reflect leaf-stem ratio, legume/grass mix, and weeds present in a particular location within the same cutting.

1. Sample by forage lot. The forage from every field and cutting is different. When sampling, divide hay into lots based on known differences. Identify your forage inventory and sample by lots. A forage lot is hay or silage taken from the same location, field, or farm, the same cutting (within a 48-hour period) at the same plant maturity, with similar amounts of grass, weeds, rain damage, or preservative treatment. A lot may range from several bales to several tons of hay. Do not combine hays of different qualities or cuttings into one composite sample. Test results will not be useful for making feeding decisions. Keep a record of quantity and location of each lot sampled
2. Sample at the optimum time. Collect hay or silage samples as close to the time of feeding or sale as possible. Sampling immediately before feeding accounts for any heating or weathering losses that may have occurred during storage.
3. Select a sharp, well-designed coring device. Forage tests are based on small samples that may represent several tons of forage. Several grab samples from a windrow or bale or a single flake from a small rectangular bale are not sufficient. Use a sharp core sampler or hay probe to collect the forage sample from bales or stacks after harvest. A greater number of small samples is more representative than fewer large samples. A core sampler should have an inside diameter of 3/8 to 1 inch. A coring device with an extremely small-diameter may not cut or represent the leaf-stem ratio properly, and a very large-diameter probe may

produce too large a sample for efficient shipping and laboratory processing. A sharp cutting tip improves the efficiency of sampling and helps to collect a more representative sample. Sharpen or replace cutting tips regularly. Using larger probes requires considerably more effort, an important consideration if sampling with a brace or a low-powered electric drill.

4. Sampling bales and stacks of hay. To sample bales and stacks of hay, take at least 20 cores, one each from widely separated bales or stacks representative of the lot being sampled. Sample large and small rectangular bales by taking cores (12 to 15 inches deep) from the center of the end of the bales.
5. Sampling chopped silage crops and baleage. Producers can either sample chopped silage crops as they are stored or as they are removed from storage for feeding. For sampling silage to be stored, collect a representative handful or two of chopped forage from each of several loads coming from a particular field at harvest. Mix the samples thoroughly and place in a sealable plastic bag, squeezing out excess air. Store the samples in a freezer, and submit the frozen composite sample to the laboratory.
6. Keep good records. Record name, date the crop was harvested, date sampled, and an identifier code or number for the lot on the bag in permanent marker. When you receive the test results, this helps you identify the proper lot for correct feeding or marketing. The lot identification should match your records of lot locations. It is also a good practice to write a brief description of the type of forage included in the sample. Some laboratories use this information in the analysis procedures. Keep a record of similar information for reference.
7. Ship samples immediately. Hay and silage samples are perishable. Ship or deliver samples to the laboratory as soon as possible to prevent moisture loss and microbial deterioration of the sample. Mail samples early in the week to minimize the shipping time to the lab. Avoid sending samples over a weekend or holiday

For more information look up the publication - Forage Sampling Procedures and Equipment MF 3177, https://bookstore.ksre.ksu.edu/pubs/MF3177.pdf or contact the Hodgeman Extension Office at 620-357-8321.

Nitrate Toxicity

The potential for high nitrate concentrations in crops such as corn, sorghum, canola, cereal grains, and some grasses occurs after exposure to drought, hail, frost, cloudy weather, or soil fertility imbalance. Nitrates accumulate in the lower portion of these plants when stresses reduce crop yields to less than those expected, based on the supplied nitrogen fertility level. Feeding harvested forages or grazing plants that are high in nitrates can be toxic to livestock because the metabolism products from nitrates interfere with the ability of blood to carry oxygen, causing asphyxiation.

Nitrate toxicity is a misnomer because nitrite (NO_2), not nitrate (NO_3), is poisonous to animals. Normally, the nitrites are converted to ammonia and used by rumen microorganisms as a nitrogen source. But, if nitrite intake is faster than its breakdown to ammonia, nitrites will begin to accumulate in the rumen. Nitrite is rapidly absorbed into the blood system where it converts hemoglobin to methemoglobin. Red blood cells containing methemoglobin cannot transport oxygen, and the animal dies from asphyxiation.

Animals under physiological stress (sick, hungry, lactating, or pregnant) are more susceptible to nitrate toxicity than healthy animals. Toxicity is related to the total amount of forage consumed and how quickly it is eaten, but, generally, if forages contain more than 6,000 ppm nitrate, they should be considered potentially toxic (Table 1).

Table 1. Level of forage nitrate (dry matter basis) and potential effect on animals.

ppm Nitrate (NO_3)	Effect on Animals
0–3,000	Virtually safe.
3,000–6,000	Moderately safe in most situations; limit use for stressed animals to 50% of the total ration.
6,000–9,000	Potentially toxic to cattle depending on the situation; should not be the only source of feed.
9,000 and above	Dangerous to cattle and often will cause death.

Symptoms of nitrate toxicity may appear within a few hours after eating or not for several days. Signs of toxicity include reduced appetite, weight loss, diarrhea, and runny eyes. However, these are nonspecific symptoms of numerous disorders and are not a reliable diagnosis of nitrate poisoning. Lower nitrate levels can cause abortion without any other noticeable symptoms.

Acute toxicity usually is not apparent until methemoglobin approaches lethal concentrations. Symptoms include cyanosis (bluish color of mucus membranes), labored breathing, muscular tremors, and eventual collapse. Coma and death usually follow within two to three hours. Postmortem confirmation of nitrate toxicity is chocolate-colored blood; however, the color will change to dark red within a few hours after death. A veterinarian should perform the diagnosis and treatment of nitrate toxicity.

Forage suspected to contain high nitrate levels should be tested by a laboratory before feeding to livestock. Unfortunately, different laboratories may report nitrate level as nitrate (NO_3), nitrate-nitrogen (NO_3 -N), or potassium nitrate (KNO_3). Potassium nitrate, nitrate nitrogen, or percent nitrate can be converted to ppm nitrate using the conversion factors in Table 2.

Table 2. Conversion factors for expressing nitrate content of forages.

Potassium Nitrate × 0.61 = Nitrate (ppm NO_3)

Nitrate-Nitrogen × 4.42 = Nitrate (ppm NO_3)
% Nitrate × 10,000 = Nitrate (ppm NO_3)

Feeding High-Nitrate Forages

Before feeding or grazing potentially troublesome plants such as sorghum, sudangrass, or canola, have the forage analyzed for nitrates. Environmental conditions in Kansas create high nitrate concentrations in some forages virtually every year. In situations where this is a possibility, nitrate analysis is necessary to determine if the feed is potentially toxic. High-nitrate forages can be fed to animals if proper precautions are taken.

Gradually Adapt Cattle to High-Nitrate Feeds.

Nitrate toxicity frequently occurs in animals without prior exposure to nitrates. If nitrate levels in the forage are not excessively high (e.g., over 9,000 ppm) the animal will usually be able to adapt somewhat to increasing amounts in the feed. Frequent feeding in limited amounts throughout the day rather than large amounts once daily will increase the total amount that can be fed safely.

Dilute With Other Feeds.

Based on nitrate analysis, blend high-nitrate forage so that the overall diet contains less than 5,000 ppm nitrate on a dry basis. After three to four weeks of feeding, the animals normally become adjusted to nitrates and the proportion of high-nitrate forage can be increased somewhat.

Supplement Grain.

Feeding 2 to 5 pounds of grain or by-product dilutes the amount of nitrate in the total ration and provides the energy necessary for bacteria to quickly convert nitrite to ammonia. Molasses also can provide needed energy for nitrite reduction but may be cost prohibitive.

Feed a Balanced Ration.

Formulate rations to ensure adequate protein, energy, vitamin A, and other nutrients. Nitrates may increase the requirement for vitamin A, but excessive supplementation is unjustified. Nonprotein nitrogen (urea) may not be well utilized and should not be fed with high-nitrate forages.

Do not Feed to Stressed Livestock.

Animals that are sick, hungry, pregnant, or lactating have a lower tolerance for nitrates than healthy animals.

Provide Clean Drinking Water.

Frequent intake of high-quality water is important for optimal rumen fermentation. Analyze the livestock water supply to determine whether it is contributing to the nitrate burden of cattle. Ponds or ditches that collect runoff from feedlots, heavily fertilized fields, septic tanks, or manure piles are likely polluted with nitrates.

Summary Guidelines to Reduce Nitrate Toxicity

- Pay close attention to potentially troublesome plants, such as sorghum, sudangrass, other summer annuals, and brassica species, which often have high nitrate levels.
- Avoid excessive application of manure or nitrogen fertilizer.
- When harvesting high-nitrate forages, raise the cutter bar 6 to 12 inches to exclude basal stalks. This also will minimize harvesting many weed species that have accumulated nitrate from shading.
- Delay harvesting any stressed forages after conditions improve. Two weeks of favorable weather generally are required for plants to reduce accumulated nitrate.
- Never feed green chop that has heated after cutting or been held overnight.
- Harvest plants containing high levels of nitrate as silage rather than as hay.
- Have representative samples of suspect forage analyzed before feeding.

For more information look up the publication - Nitrate Toxicity MF3029 https://bookstore.ksre.ksu.edu/pubs/mf3029.pdf or contact the Hodgeman Extension Office at 620-357-8321.