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Proper sampling (coring) of hay bales and stacks

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photos by Glenn E. Shewmaker

Forage sampling through coring of hay bales and haystacks allows growers and buyers to determine the protein, fiber, and other nutrient content of forages fed to livestock. Testing for forage quality helps livestock producers match forage with type of animal—for example milking cows need more protein than dry cows.

Core sampling provides to a laboratory a representative sample of a large lot of hay. To have a true test, the core sample must represent the leaf/stem ratio, which varies throughout a bale, and it must represent the various weed compositions within a lot of hay. Each core sample should represent the individual bale, and enough cores need to be taken to represent the haystack or lot. Figure about 20 core samples. Allow up to an hour for taking 20 samples per lot.

The forage lab grinds all that you send and selects a thumbnail-sized sample—1- to 3-grams—to be analyzed (see Figure 1).

Timing. Forage quality declines with time, even if optimally stored. A sample taken from the same lot of hay the day it is baled is expected to have lower fiber values than a sample taken from the same lot six months later. Therefore, sample as close to the time of sale or utilization of the hay lot as practical. Most labs return results within a few days to a week.

Persons wanting a hay test should handle the sample properly as described next.

Figure 1. The amount of ground forage sample analyzed by chemistry or near infrared reflectance spectroscopy (lower right) is small in relation to the core sample (lower left and center) of one lot of hay that is sent to a lab. The stack of hay in the background is 3 separate lots from the same field, each from a different cutting.

Choose a sharp coring tool

There are several types of probes. The following are important considerations in choosing a hay probe:

- Push or drill type; (manual/powered)
- Good sharp tip, serrated or scalloped for drill-type; scalloped or straight for push-type
- Ability to sharpen and/or replace tip
- Ease of use and easy penetration into bale
- Length of shaft can be 12- to 24-inches
- Diameter of shaft can be 5/8- to 3/4-inch
- Ease of core removal. Some probes have a collection container that stores the core (see Figure 3-C.)
- 20 cores produces about ½ lb (250 grams) of sample
- Durability and ease of transport

If the tip is dull (Figure 2) , **replace it or sharpen it.** If the cutting edge is dull, and does not cut stems and leaves properly, the forage material will be pulled out of the tube. The coring tool should have an inside diameter of at least 5/8-inch and no more than 3/4-inch. A cutting diameter of 5/8-inch allows for coring a sample that is easy to grind. Some probes come with a sharpening file, or tips can be sharpened at the place where you purchased the probe. Other tips are too difficult to sharpen and should be replaced.

More about probes and certified labs

University of Idaho Extension offices in hay-growing counties often have probes growers can borrow at low or no cost. Also, the National Forage Testing Association offers more details about hay probes and lists certified forage testing laboratories throughout the U.S. at their website—http://forage testing.org. Learn more about Star Quality Probes at http://www.starqualitysamplers.com/forage.php. In 2011, probes cost between $100 and $200. Forage quality sample tests vary in cost from $10 to $50, depending on methods and nutrients analyzed.

Figure 2. Compare the sharp (left) and dull (right) 3/4-inch diameter serrated tip on a 1-inch tube of a Penn State drill-type single-sample probe. If your probe tip is dull, sharpen it or get a new tip. For these serrated tips, it's easiest to buy a replacement tip when yours is dull.

Not satisfactory. Open augers or corkscrew devices will selectively sample leaf or stem parts and are not satisfactory tools. Never use the "grab-a-handful" or "one-flake" sample methods.

Different probe methods for collecting samples. Coring probes have different methods of collecting samples (Figure 3). Probes without a sample container must be emptied after each time the probe is inserted. Use a wooden or plastic dowel to force out contents of each probe and deposit the material into a sealable bag (Figure 4). Dowels often are included with a probe's purchase.

Guidelines for coring a lot of hay

1. Identify a single lot of hay. The lot should be from the same cutting, variety, field, stage of maturity, and it should be harvested within 48 hours. The chosen lot should not exceed more than 200 tons. When differences in timing or location or variety occur, identify the forage as multiple lots and test each lot.

2. Probe near bale center. Probe bales as near bale center as possible. For rectangle bales, sample from the butt end; sample round bales from the curved side. Place the probe's serrated edge perpendicular to the bale and core in 12- to 18-inches. The coring probe cuts through the layers of the hay bale, filling the tube portion of the probe with the sample (Figure 5). Do not slant the probe or sample from the flat sides of the bale.

3. Numbers, sizes of core samples. Research on large and small lots has shown that 20 cores—each from a different bale—will allow good representation of the entire lot of hay. Take more cores (20 to 40) for larger lots or if the hay is variable.

A good average size sample should weigh from 1/3 to 1/2 lb. (150 to 200 grams) as shown in Figure 4. The number of cores versus the weight of samples will depend on the kind and size of hay probe. Very small volume samples may not be representative of the entire hay lot. Large volume samples are difficult for laboratories to grind. Consequently, they may not grind the entire sample, thus defeating the purpose of an accurate sampling technique.

Figure 3. Compare (A) the 3/4-inch diameter serrated tip on a 1-inch tube of a Penn State drill-type single sample probe, with (B) the 3/4-inch diameter scalloped tip on a tube of an AMS drill-type multi-sample probe, and (C) the 1/2-inch diameter scalloped tip on a Star Quality multi-sample push probe. Probes B and C come with a sample container. The remaining item is a wooden or plastic plunger (dowel) that comes with probes to help remove core samples from the probe.

Figure 4. This l/2-gallon sealable freezer bag holds samples of 20 hay bale cores weighing a total 135 grams or 0.3 pound. They came from a 1/2-inch diameter probe. The bag is labeled to enable lot-identification after lab results are in.

Large-diameter cores. If you are using a large-diameter core, such as the 3/4-inch Penn State probe, a better sampling method is to obtain 3 sample bags, each with 6

Figure 5. A sharp core tip inserted correctly will cut stems and retain leaves in the same proportion as in the bale. This 0.5-inch tip is on the Star multi-forage sampler and is scalloped and expanded, which allows easy insertion by pushing and easy extraction.

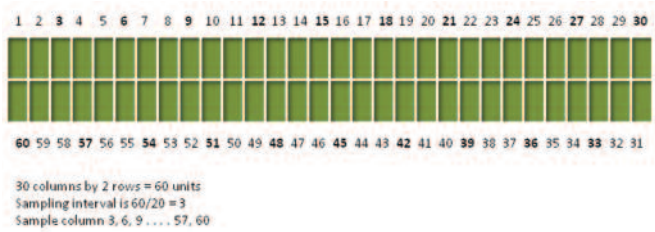

Figure 6. In these 60 bales of hay, to determine a sampling interval, divide the total bale units at ground level by number of samples needed. In this example, you want 20 samples, so the sampling interval is 3. Extract a core sample from the center of each bale with a bolded number.

or more different cores from a lot of hay. Then have the laboratory analyze each of the three bags. This procedure will improve the probability that the entire sample is ground by the lab. With three sets of data representing the lot of hay, you can determine the variation in the lot.

4. Both sides/various heights. Random samples should be taken from both sides of a haystack and from bales at various heights within the stack. Try to take samples from as broad a group of bales as possible within the lot.

Understand that all bales may not be available to sample. The key is to represent the full variation of the hay lot. A system of sampling the stack at regular intervals can provide 20 random samples. To find the sampling interval, divide the number of bale units by the number of samples needed.

Example: A stack of 240 1-ton bales in 30 columns that are 2 rows wide and 4 bales high should be sampled at every 3rd bale on the ground layer to get 20 samples (Figure 6). The number of bale units at ground level is 30 (columns) x 2 (rows) = 60. The sampling interval is 60/20 (samples needed) = 3. It is not necessary to use a ladder to sample higher up in the stack, but always sample both exposed sides of the stack.

5. Combine and seal samples in bags. Collected core samples from 1 lot of hay can be combined into a single sample bag. Or, collect 6 or more distinct cores into 3 sample bags. Core samples can be stored in sealed polyethylene freezer bags. Each bag represents a forage sample.

Identify each bag by date, cutting, forage type, location, and owner. Some labs provide plastic sealable bags with labels that allow the above information and type of analysis desired. Do not expose the samples to heat or direct sun; keep the samples cool and send to the laboratory as soon as possible.

6. Do not divide the un-ground sample to try to "check labs" because that will almost guarantee different results. If you want to compare labs, ask the lab to split the ground sample or to send the sample they scanned—if done by near infrared reflectance spectroscopy (NIRS)—to the second lab. Use a National Forage Testing Association certified lab (see page 1).

Following the above guidelines to collect representative forage samples will help ensure reliable results.

References

Shewmaker, Glenn E. Idaho Forage Handbook 3rd Edition. 2005. University of Idaho BUL 547.

National Forage Testing Association, "What to look for in a Hay Probe:" http://foragetesting.org.

Trade Names—To simplify information, trade names have been used. No endorsement of named products is intended nor is criticism implied of similar products not mentioned.

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