Recommended Principles for Proper Hay Sampling

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INTRODUCTION

Proper sampling of hay and forage is of tremendous importance to assure an accurate forage test. Remember, a lab test is only as good as the sample provided to the lab. Here's the dilemma: Hundreds of thousands of pounds of highly variable plant material must be represented in a single, tiny, thumbnail-sized sample!! Often, the sample actually analyzed by the lab is often only ½ gram! This sample must not only represent the proper leaf-stem ratio and the legume/grass mix, but also reflect the spotty presence of weeds. Sampling variation is a significant problem in hay testing, and causes millions of dollars in lost revenue each year by either buyer, seller, or in animal performance. In practice, hay sampling produces more variation in results than does lab error. However, if sampling protocol is carefully followed, sampling variation can be reduced to an acceptable level, and the potential forage quality successfully predicted. The following steps have been compiled from various recommendations that have been in place for years and are widely considered to be the key elements of a standardized sampling protocol:

STANDARDIZED PROTOCOL TO ASSURE A REPRESENTATIVE SAMPLE OF HAY

1. **Identify a single 'lot' of hay.**
   This is a key first step to proper hay sampling, and one frequently ignored. A hay lot should be identified which is a single cutting, a single field and variety, and generally be less than 200 tons. Combinations of different lots of hay cannot be represented adequately by a forage sampling method; different lots should be sampled separately. Don't mix cuttings, fields, or hay types.

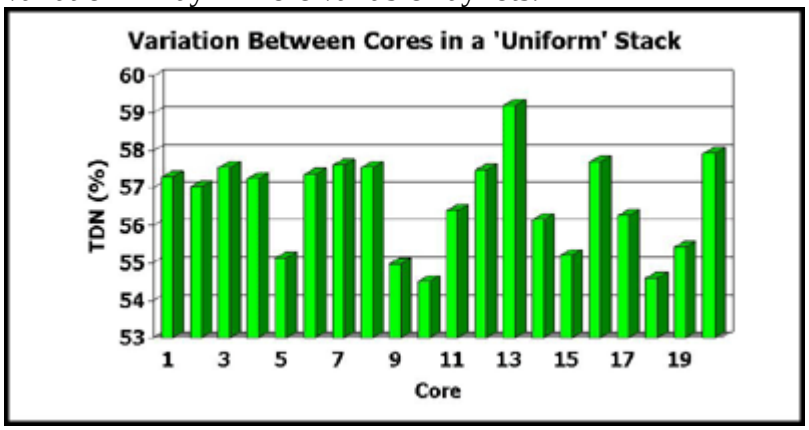
2. **When to Sample?**
   It is important to sample the hay either as close to feeding, or as close to point of sale as possible. Dry matter measurements are especially subject to changes after harvest and during storage, but other measurements may also change. Hay immediately after harvest normally goes through a process of further moisture lost known as a 'sweat'. During this period, hay may heat up due to the activities of microorganisms, driving residual moisture from the hay. Thus, moisture content is likely to be reduced in the days and weeks after harvest. If the hay has been baled at excess moisture, further biological activity may result in molding, or even (under very high moisture conditions) spontaneous combustion of hay. However, after hay has equilibrated to the range of 90% DM (10% moisture, depending upon humidity), it is typically quite stable. 'As received' dry matter measurements should be used to adjust quantity (tonnage, yield), not quality parameters, which should be compared on 100% DM basis.

3. **Choose a sharp, well-designed coring device.**
   Use a sharp coring device 3/8-3/4" diameter. Never send in flakes or grab samples, it is nearly impossible for these samples to represent a hay lot. "Hand-grab' samples have been shown to be significantly lower in quality than correctly sampled forage. The corer should have a tip 90o to shaft, not angled—studies have shown that angled shafts push aside some components of hay, providing a non-representative sample of the entire mix. Very small diameter tips (<3/8") do not adequately represent the leaf-stem ratio of the hay. Too-large diameter or too-long probes (e.g. > 24") provide good samples, but give too much forage in a 20 probe composite sample—thus the

sampler may stop before 20 cores are completed or the lab may not grind the whole sample (see below). The length of probe should allow probing to a depth of 12”-24”. Studies have shown this depth to successfully characterize the variation in hay, even in large (1 ton) bales, and no significant differences were seen between a 32” and 12” probe. A range of probe tip designs have been used successfully, from serrated to non-serrated tips—it is probably most important that the tip be sharp (and maintained sharp), and not create ‘fines’ during the cutting action, but cleanly cut across a cross-section of hay. Some probes are power, hand-brace, or auger driven, whereas others are push-type, both of which may work well. Many (not all) probes can be used to successfully represent a hay lot as long as they follow these principles: they easily penetrate the bale, fairly represent the leaf-stem ratio, can be easily sharpened, and produce approximately ½ lb (200 g) of sample in about 20 cores to a depth of 12”-24”. See a listing of probes at NFTA website.

4. **Sample at random.**
The sampler should walk around the stack as much as possible, and sample bales at random. Both ends of bales should be sampled by walking around the stack. This is sometimes difficult since all of the bales are not available to the sampler (they may be against walls of a barn or up too high for practical sampling). However, the sampler should make every attempt to sample in a random fashion—this means not to bias either for or against any bales in the stack. For example, the sampler may walk 15 steps, sample, walk 20 steps, sample, walk 5 steps, sample, while walking around stack—trying to represent all areas of the stack. Don’t avoid or choose bales because they look especially bad or good--If 20 cores are taken, they won’t make much difference anyway. Avoiding or choosing bales introduces bias.

5. **Take enough cores.**
We recommend a minimum of <u>20 cores</u> for a composite sample to represent a hay lot. This is the same for large (e.g. 1 ton bales), or small 2-tie or 3-tie bales. This is because core-core (and bale-bale) variation in forage quality is tremendous (e.g. 5-7 % points ADF or CP). Sampling a large number of locations and bales throughout the stack to create a composite sample is a key aspect of representing the full variation contained in a hay lot. It is recommended to take <u>more</u> than 20 cores (e.g. up to 35) with very large lots (100-200 tons), or with highly variable lots (e.g. lots that may have non-attached leaves or are from very weedy fields). With small bales, sample 1 core per bale, >20 bales; with larger (e.g. 1 ton) bales, take 2-3 cores per bale in the center of the ends, sampling >10-12 bales. A larger number of core samples is generally better at characterizing variation in hay in more variable hay lots.



6. **Use proper technique.**
   Sample butt ends of hay bale, between strings or wires, not near the edge. Probe should be inserted at 90º angle, 12”-18” deep. Do not sample in the same exact spot twice. Do not use any technique which is likely to misrepresent the leaf-stem ratio. The sides or the top of the bale should not be sampled, since these cores will only represent one flake from a single area of the field, and additionally misrepresent the leaf-stem ratio. With round bales, sample towards middle of bale on an angle directly towards the center of the bale.

7. **Sample amount: “not too big, not too small”.**
   Sampling should be done so that about ½ lb of sample is produced. Too-small samples don’t fairly represent the full range of variation in the hay lot. Very big samples (common with large length or diameter probes) are excellent at representing the hay but have practical disadvantages. Large samples cannot be easily ground by the labs—many labs will simply sub-sample such large samples before grinding, defeating the entire purpose of good sampling technique! The sampler should ensure that the entire sample is ground by the lab—this is important to check. If your lab is not grinding the whole sample, ask why—it could be that your sample is too large. Only work with labs that are willing to grind the entire sample (after a DM sample for field DM is taken). But you should also assure that you are providing a reasonable ½ lb sample, so that it can be practically handled by the lab. If a probe is too big or small to produce about ½ pound in 20 cores—get a different one! (see list of probes on NFTA website)

8. **Handle samples correctly.**
   Seal Composite 20-core sample in a well-sealed plastic bag and protect from heat. Double bagging is beneficial, especially for DM measurements. Deliver to lab as soon as possible. Do not allow samples to be exposed to excess sun (e.g. in the cab of a pickup truck). Refrigeration of hay samples is helpful, however, dry hay samples (about 90% DM) are considered fairly stable.

9. **Never split samples without grinding.**
   It is important to occasionally double check the performance of your lab by comparing with another (or several other) labs. However, never split un-ground samples and send them to two different labs—the samples are likely to be genuinely different! To test two labs, either grind and carefully split the sample, or better yet, ask for your ground sample back to send to another lab. Use several samples to test average potential bias between labs. Don’t work with labs that are unwilling to do this—good labs should be wiling to test their performance and answer questions with regards to consistency of lab results. Ask for their NFTA results!

10. **Choose an NFTA-Certified Lab.**
    The first step in choosing a high-quality hay testing lab is to determine whether they participate in the NFTA proficiency certification program. The National Forage Testing Association, a volunteer group set up by hay growers, sends blind samples to labs, and they must match the true mean within an acceptable range of variation. NFTA labs have demonstrated their commitment to good results, are more likely to be interested in accuracy. Additionally, programs such as California’s ‘California Recognized’, the Midwest NIRS consortium, or other voluntary proficiency programs provide an additional opportunity for labs to prove their proficiency. However, these programs only work if the clientele (you) pays attention to them. Choose a lab that chooses EXCELLENCE! Choose an NFTA lab (see www.foragetesting.org for a listing of NFTA-certified labs)!