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BY O. E. STRAND and M. F. HUTJENS

Sampling and Testing Forages for Feeding Value

Importance of Forage Evaluation

Forage crops provide the basic feed supply for dairy and beef cattle, sheep, and horses in Minnesota. Nearly 3.5 million acres of legumes and grasses are harvested for hay or low-moisture silage each year. In addition, more than 800,000 acres of corn and substantial quantities of oats are harvested yearly for silage. These crops vary widely in nutritional value. Differences in species, time of cutting, moisture content, and method of handling and storage can cause wide variations in digestible protein and total digestible nutrient content of the forage. It is necessary to know the nutrient content to calculate balanced livestock rations. It is also important to know the moisture content of the forage crops to determine the amount of forage an animal has eaten or is likely to eat. In addition, the moisture content will indicate storage conditions that may influence forage quality.

Rough estimates of forage quality can be made based on stage of maturity of the crop at harvest, species composition, moisture content of the crop, and physical condition such as color, leafiness, and presence of mold, foreign material, etc. With experience, careful observation, and the use of forage harvest records, you can make reasonable estimates of forage quality. These estimates of forage quality are useful but are not accurate enough to use as a basis for extensive feed analysis programs. For example, Dairy Herd Improvement (DHI) computer programs require measures of digestibility, protein, and amount of intake to estimate the specific quality of the forage in order to determine the amount of grain and protein supplement needed to meet the cow's requirements for body maintenance and milk production. If forage quality estimates are too low, the dairyman may overfeed grain and supplement resulting in high feed costs. If forage quality estimates are too high, too little additional concentrate feed will result in lost milk production. Dairy cow herd operators making use of a least-cost ration computer program need accurate estimates of forage quality in order to analyze feeding alternatives realistically. Performance and digestion trials with livestock provide the most reliable method for determining forage quality. However, these tests are expensive, time consuming, and are practical only for research purposes. Chemical tests to determine components of forage quality are less expensive, take less time, and are considerably more accurate than rough estimates of forage quality, if good sampling procedures are used.

Number of Forage Samples Needed

The forage sample must be representative of the forage to be fed or misleading test results will occur. Remember that the quart sample needed for testing will represent several tons of forage. Sample each field separately, especially if there are substantial differences in stage of maturity at time of cutting, forage species, rain damage, or other factors. Also, you should sample first, second, and third cuttings separately. The first cutting of hay will usually be affected more by delayed harvest

than will second and third cuttings.

The quality of hay or haylage will usually vary more than the quality of corn silage. If the silo is filled rapidly with corn silage of uniform maturity and grain content from a field with fairly uniform soil fertility, one representative sample of the corn silage may be enough to determine feed value. However, if the moisture content is variable, one sample is not enough.

Taking the Forage Samples

About one quart of forage is needed for testing. To obtain a representative sample, take several subsamples from the forage and mix thoroughly in a clean container. Fill a quart plastic bag, remove as much air as possible from the bag, and close tightly. Refrigerate haylage or corn silage after collection until ready for delivery to the testing laboratory. Label each sample bag clearly with a sample number and your name and address. Record the origin of each sample in your record book. Mail samples early in the week, if possible, so they can arrive at the laboratory and be processed before the weekend. Detailed suggestions for sampling each type of feed are given below:

Baled, loose, or chopped hay:

1. Take at least 12 subsamples from different bales or locations in loose or chopped hay.
2. Use a sharp sampling probe or bale corer, if possible, to reduce the errors of sampling. These sampling tools help get a representative section of stems and leaves. Most sampling probes can be used either with or without an electric or hand drill. In sampling baled hay, insert the probe in the end of the bale (see below). The probe can also be used for sampling chopped or loose hay. Hold the probe in a vertical position and sample where your weight has compressed the hay.



Sampling baled hay.



It is almost impossible to get a representative sample of hay by using bale slices. In chopped hay, representative hand-fuls can also be taken to obtain a composite sample.

3. Take a separate sample from each lot or cutting of hay. Do not attempt to combine hays of different quality or different cuttings into one composite sample. The test results will not be meaningful because you will not be able to duplicate the original mixture accurately enough when feeding the forage.
4. Hay can be sampled either at harvest or in storage. Make an effort to store each lot of hay separately so that adjustments in feeding can be made if indicated by test results.

Haylage, corn silage, or oats silage:

1. You may sample these feeds as they are being ensiled. However, keep in mind that any fermentation or leaching losses in feeding value will not be measured. Collect 3 or 4 grab samples from the first load in the morning and the first load in the afternoon each day. Refrigerate and combine these subsamples. Mix well and take a quart sample of this mixture for testing. Repeat this sampling procedure for each field or lot of silage.
2. To identify the silage lot, different brightly colored strips of plastic can be fed through the blower when the last of each lot is ensiled. Record the plastic color and silage lot number. Look for these strips when the forage is being fed if differences in test results justify a change in ration.
3. If silage was not sampled at time of harvest, collect representative grab samples of the silage as it is being fed. Avoid sampling spoiled silage. Collect subsamples from more than one feeding, if possible. Refrigerate these subsamples during collection, mix and fill a clean quart plastic bag for testing.

You may wish to enlist the aid of your local county extension agent in forage testing. He has a list of forage testing laboratories and prices for the different tests needed. He is also available to interpret and discuss the test results with you and can assist you with balancing rations, calculating ration costs, or other analyses if necessary.

Kind of Forage Tests Needed

For most forages, tests for crude protein, crude fiber, and moisture content are usually sufficient to predict forage quality. However, if the forage is brown or caramelized due to heating in storage, it is likely that the digestibility of the protein has decreased. A digestible protein test should be made on this type of forage. Digestible protein may be determined by use of an acid detergent fiber (ADF) test and an analysis of the unavailable protein (nitrogen) in this ADF fraction. The unavailable (indigestible) protein is then subtracted from the total or crude protein content of the feed to give digestible protein. A pepsin test (using this protein-digesting enzyme) may also be used to determine digestible protein.

Tests for digestible feed value are more expensive but will give more reliable results for heat damaged forage samples. Remember that a crude fiber (or acid detergent fiber) test is necessary in addition to digestible protein if a net energy determination of the forage is to be made. The following combinations of forage tests are suggested for Minnesota farmers:

- * Crude protein, crude fiber, and moisture for alfalfa hay, haylage, and corn or oat silage put up under normal conditions and showing no signs of heat damage.
- * Acid detergent fiber, together with crude protein and moisture, to predict the digestibility of mixed grass and legume forage more closely than a crude fiber analysis (can be used for other forage samples as well).
- * Digestible protein (using acid detergent fiber or pepsin test) and moisture content for forage that has heated or caramelized in storage. A crude fiber test is needed in addition if net energy of the forage is to be determined.
- * Moisture determination only, if desired, for corn silage put up under normal conditions and at near hard-dent stage of maturity. Moisture tests are useful to determine how much dry matter an animal has eaten or is likely to eat. (A moisture determination is also useful to indicate storage conditions that may influence forage quality.) You can make moisture tests at home. See Agronomy Fact Sheet No. 24 "Determining Moisture Content of Forages" for instructions.

Using the Forage and Feed Analysis

Forage testing is important because forages represent from 33 to 75 percent of the dairy cow's ration. However, forage tests are of little value unless used in formulating and balancing rations. The moisture value will give an estimate of how much forage or feed an animal can consume. An average dairy cow will consume about 3 pounds of dry matter per 100 pounds of body weight. If fiber of high-grain or all corn silage rations is too low, dairy cows will experience a drop or depression in milk fat test. If fiber is too high, inadequate energy intake will result in low milk production. The dairy cow needs about 14 percent crude protein in the total ration for optimal milk production. If protein needs are not met, both milk production and body weight of the animal will decrease.

Good forage quality and a balanced ration will reduce feeding costs while maintaining top production. Periodic testing of representative forage samples is an effective way of determining forage quality. If quality components are unsatisfactory, steps can be taken to balance the ration and also to improve forage quality. Check with your county extension agent for information on balancing dairy rations or obtain a copy of Extension Bulletin 218, Feeding the Dairy Herd.

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