Forage Crop Sampling for Nutrient Management

Nutrient Management Factsheet – No. 4 in Series

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This factsheet describes the steps to collect representative forage crop samples that will be analyzed for dry matter content and nutrient concentrations.

To develop a nutrient management plan, the crop nutrient requirements must be estimated. Crop nutrient requirements depend on dry matter yield and nutrient concentrations (of nitrogen, phosphorus and potassium). These values can be estimated but the plan will be more reliable if the values are farm-specific.

To get accurate analytical data, the crop samples collected must be typical of the whole crop. Representative crop samples should be collected and analyzed at each crop harvest. Results are used to monitor the effectiveness of the current year's plan and to help predict the crop nutrient requirements of next year's crop.

Sample Collection

Silage (grass or corn): Collect 10-15 samples (one handful per sample) from each field at the time of forage harvest, and mix samples together in a clean plastic bucket. Collect samples while the silage is being unloaded. Collect one sample per load, unless there are less than 10 loads from a field, in which case take two samples per load. Fill a freezer bag or 1 L plastic container with the sampled material.

Hay Bale Sampling: Hay is most accurately sampled using a hay corer. You can take samples by hand (i.e. grab samples) instead if there is no corer, but the proportion of stems to leaves cannot be as well represented, especially for alfalfa.

If using a hay corer or probe (**Figures 1 and 2**), it must have a tip sharp enough to cut through the hay. It must have an internal diameter of at least 1 cm (3/8 inch), and it must be long enough to extend into the middle of a large round bale. When sampling a square bale, insert the corer into the middle of one end of the bale and drill into the middle of the bale (**Figures 2 and 3**).

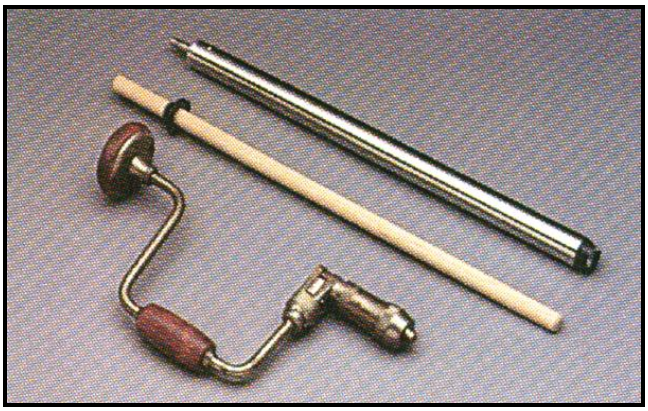

Figure 1. Hay corer

Figure 2. Collecting a core from a square bale

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On round bales, insert the corer into the round part of the bale (as opposed to one of the flat sides) and drill into the middle. Collect cores from at least 10 bales from each field to make a composite sample. Because hay is difficult to mix and subsample accurately, submit all cored material to the lab.

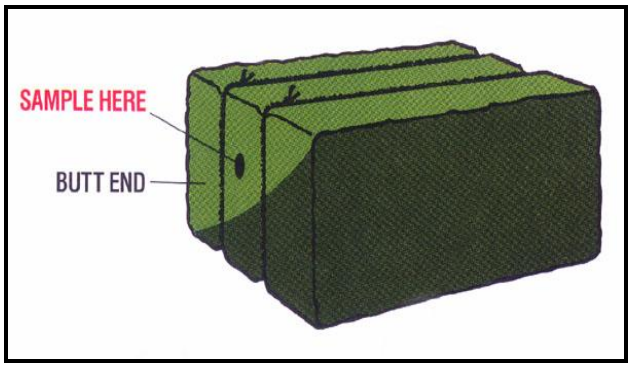

Figure 3 Bale sampling locations

If hand-collecting samples, sample as accurately as possible the proportion of stems to leaves. As grass hay fractures less during baling than alfalfa, it is easier to get a representative hand sample from grass. Open each bale and take a grab sample from the middle – one handful per sample. Sample at least 10 bales from each field. For large round bales, use the field sampling procedure below.

Field sampling: Hay should be sampled in the field just before baling. Collect 10 grab samples (one handful per sample) from the inside of the swath equally distributed throughout the field. Collect samples in a plastic bag and close tightly when sampling is complete. Submit the whole sample to the lab.

When Should Samples be Collected?

Silage: Collect samples from each cut of silage as it is being produced. Samples can be frozen and submitted together following the final cut of silage or submitted following each cut. Once average values have been established for forage and corn silage produced on the farm, sampling frequency can be reduced.

Hay: Sample hay either as it is being produced in the field, or after harvest. Sampling can occur anytime if the hay from each field can be identified. It may be simpler, however, to sample hay from each field before it is mixed in with other hay lots.

When to Group Fields Together

Collect a separate sample from each field if the age, species composition or fertility is different from all other fields. If several stands are the same age, species and have had the same management since establishment, the forage from them can be sampled and submitted to the lab as one sample. The forage quality information from the sample will then apply to all the fields that made up the sample.

Handling and Labeling Samples

Samples should be stored in a tightly sealed plastic freezer bag or container. Send samples to the lab in a refrigerated container. Try to ensure that samples arrive at the lab on a weekday and do not get delayed over a weekend en route.

Label each sample with the sample date, field(s) from which the sample was taken, the forage type, and your name or the farm name. A good labeling method for moist samples (such as silage) is to double bag the sample, and then slip a paper label between the two bags. Alternatively, a paper label on a string can be tied to the bag. Paper labels placed in with silage will disintegrate and information marked on a plastic bag can rub off.

What Analyses are Required?

To use the Nutrient Management Planning software produced for the Canada-BC Environmental Farm Plan program, forage samples should be analyzed for the following parameters:

- crop protein
- phosphorus
- potassium
- moisture

If the analysis will also be used for determining livestock feed rations, other parameters such as nitrates, acid detergent fibre, and neutral detergent fibre may also be desired.

Interpreting Crop Lab Reports

Crop protein content: The lab will provide the percent protein content on a dry basis. You should use this value.

Crop moisture or dry matter content: The lab report will contain the crop moisture or dry matter content as a percentage of the total sample weight. The dry matter percentage is then multiplied by fresh matter yield to determine the total dry yield (see step (d) of Table 1). The dry yield is used to estimate the crop's nutrient requirements.

Calculating Crop Dry Yield

Silage: To determine total dry yield, start by finding out the loads of silage taken off each field (from all cuts), the average weight per load and the dry matter percentage. Then follow steps (a) to (d) in Table 1.

It may be possible to verify the average weight of a silage load by using a local drive-on scale. Feed and fertilizer plants, lumber mills and occasionally large intensive livestock operations have drive-on scales. Weigh at least three typical loads of silage – either the silage wagon itself or the truck used to haul silage to storage. Subtract the vehicle empty weight from the vehicle plus silage weight to get the wet weight of silage. Weigh all the different types of bulk moist feed grown (haylage, corn or grass silage).

Alternatively, a rough estimate of the weight of a silage load can be obtained by knowing the volume of the high-dump or truck. On average, silage weighs 5 pounds per cubic foot, regardless of whether it is fresh or partially dried before ensiling, or corn or grass silage. Multiply volume (cubic foot) by 5 (pounds per cubic foot) to estimate weight in pounds. Many types of silage high-dumps have the volume indicated on the side or in the manufacturer's manuals. The volume of the high-dump can also be estimated by multiplying height by width by length.

Hay: Total 'as produced' yield of hay per field is determined by multiplying the average weight per bale by the total number of bales produced from each field over the season. The weight of small square bales is relatively uniform; however, round bale weights vary significantly. You should weigh at least 10 to 15 bales to get a reliable average weight.

The 'as produced' values (or wet yields) should be corrected to 'dry yields' (as in step (d) in Table 1). If the dry matter of the farm's hay has not been measured, use the average value of 90% dry matter (10% moisture).

Conversions
Weight (kg) = Weight (lbs) x 0.45
Tonnes per ha = Tons per acre x 2.25

Table 1. Determining dry matter yield (assuming 29 loads/field, 6035 kg/load and 35% dry matter)

Step	Calculation	Example
a	# loads from field (all cuts for year) x kg/load = total wet yield (kg) from field	29 loads from field x 6035 kg/load = 175,000 kg wet weight of silage
b	total wet yield (kg) / field size (ha) = total yield/ha (kg)	175,000 kg / 5 ha = 35,000 kg/ha wet weight
c	total wet yield (kg/ha) / 1000 = total yield (tonnes/ha)	35,000 kg/ha / 1000 = 35 tonnes/ha wet weight
d	total wet yield (t/ha) x (dry matter%* /100) = total dry yield (t/ha)	35 t/ha x (35/100) = 12.25 t/ha dry yield

* dry matter% = 100 – moisture content, e.g. if moisture content = 67%, dry matter = 33%

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