



Dry matter content of conserved forages: Representative sampling

Frank Mickan, Ellinbank

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To ensure a satisfactory fermentation and to avoid aerobic deterioration, forage harvested and baled silage must be conserved within specific dry matter (DM) content ranges. To avoid deterioration in storage or spontaneous combustion (fire), hay must also be conserved below specific moisture levels.

This Agriculture Note discusses how to obtain a representative sample from forage for the purpose of determining DM content or feed analysis. It includes sampling before or during harvest or from silage and hay after storage.

Refer to Agriculture Note AG1239: Dry matter content of conserved forages: Measurement of dry matter content for methods to measure the dry matter/moisture content of conserved forages (silage and hay).

What is dry matter content?

All feeds are composed of dry matter (DM) and water. Silage is usually referred to in terms of DM content while hay is referred to in terms of moisture content. So a silage with a DM content of 45% also contains 55% moisture ($100 - \text{DM \% value}$). A hay of 15% moisture content contains 85% DM ($100 - \text{moisture \% value}$).

The dry matter fraction of any feed contains the nutritional components of energy, protein, fibre, minerals and vitamins.

Water, commonly referred to as moisture, is largely the liquid located in plant cells and transportation components of conserved forages. Free water is also found on plant surfaces during wilting (silage), curing (hay) and during aerobic spoilage of these conserved forages.

How to collect representative samples for DM testing

Before testing for the DM content, a representative sample must be collected from the paddock windrows, silage or hay bales or from silage or haystacks. Having a truly representative sample for DM testing is crucial for determining the correct DM content of any end product.

This small sample has to reflect the average DM content of the entire paddock, bale batch or silage storage. An incorrect measurement can have extremely deleterious impacts in terms of feed allocation, feed weights offered to

animals, unit weights for selling, estimation of weight in cart loads for contractor charge rates and, particularly, for safe or satisfactory storage of silage or hay.

To be truly representative, it is often necessary to collect more material than is required for the test. To obtain a representative sub-sample, follow these guidelines:

- Place the collected forage onto a clean dry surface to avoid contamination or moisture.
- Mix the entire sample thoroughly. Be conscious of smaller plants, eg. clovers becoming segmented at the bottom or edge of the sample.
- Split the heap into two piles, retaining one pile for the testing.
- Split the heap into four piles if the sample is very large. Retain diagonal opposite piles, remix and split into four (or two), until the desired amount of sample is obtained.

A few handfuls of forage are required for sending to a feed testing laboratory, only a handful for the hand squeeze test and a much smaller amount for the microwave oven test.

Depending on why the DM content is being measured the area to be sampled may vary. Uniform crops such as lucerne, maize and cereals will only require a small area to be sampled. However, where crops will be highly variable, such as pastures and their mixes, a much larger area, usually paddock size, must be sampled.

Representative samples can be collected from:-

1. Mown material but not windrowed
2. Windrowed material
3. During silage stack filling
4. Silage stacks (pit, bunker, buns)
5. Baled silage and hay

Standing crops can also be sampled but are not covered in this note.

1. Mown material but not windrowed

The DM content is usually measured from windrowed (raked) material and less frequently from behind a mower. However, the DM content of mown material in whole paddocks often has to be sampled before windrowing occurs. This material will have been either mown and left as is or has been tedded (spread) soon after mowing.

Sample over a large area of the paddock unless highly confident of the material being very similar over the entire area, eg. a uniform cereal or maize crop.

Generally, avoid non-representative areas such as heavy infestations of broad leaf weeds or light vs high yielding patches. However these heavy patches may have to be accounted for, such as for hay baling, which has low tolerances for excess moisture in bales, especially large rectangular bales.

Sample the entire depth of the cut material, from top to bottom, as the material dries out faster from top than the bottom.

2. Windrowed material

The procedure for sampling windrows is similar to that for unwindrowed material (see above) except for ensuring that the sample is representative of the windrows throughout the paddock.

Material must be sampled from the top to bottom of windrows and from their complete width. The following factors may influence DM differential throughout the depth of windrows:-

- high vs low yielding crops
- dense vs low density windrows
- windrows left behind a roller type mower conditioner compared to a tined type mower conditioner

The DM contents can also vary greatly within a windrow due to other factors such as the type of rake used, operator skill, weather damage and paddock. The end result could be such as “ropey” windrows causing uneven drying, rain affected material intermingled throughout the windrow or wetter unranked material being picked up by a baler. Tops of slopes versus their bottom will also vary in DM content along with the time of day when sampled.

3. During silage stack filling

Sampling forage as it is being harvested into a silage stack is common for contractors and farmers for recording the amounts harvested (DM basis) and for determining payment. For this purpose, the hand squeeze technique is not accurate enough and the microwave oven test or feed testing laboratory are used.

As the material is being delivered to storage sites (stack, pit, bunker) by silage carts, loader wagons or trucks throughout the day, samples are collected to be measured for DM content at some stage.

The sample is best taken straight after the delivered load has been spread and before being rolled by the compacting equipment. This sample will now be more homogeneous and allows access to a larger volume of material.

The reason for the sample collection will ultimately determine the number to be collected. For payment of the DM material in the stack or for a contractor paid on a DM basis, one or two handfuls for each load may be required as the DM content will vary greatly throughout the day. However, to determine when to start harvesting, the first load only would be tested. To determine silage additive rates, the number of tests may lay between the two.

Store the samples in plastic bags within an esky or similar, with ice packs, to reduce DM losses due to respiration.

DM estimations can be done as the samples are being collected or later when more convenient.

Note: Be very careful to avoid any moving equipment on the stack.

4. Silage stacks (pit, bunker, buns)

Knowing the DM content (and its quality) is very important when estimating how much silage to feed daily or how much to add when formulating rations.

Unfortunately there can be considerable variation in the DM content (and especially quality) throughout an entire silage stack. This is compounded by the variation in DM content throughout the day(s) of harvest, whether rain affected or not, and inclusion of different paddocks or crops in the same stack. Even the way a stack is “built” (horizontal layers vs Dorset wedge) can impact on the sample taken for DM content (or quality).

Depending on the above and other factors, a silage stack can be sampled in two ways: before the stack is opened or as the silage is being fed out.

Before opening the stack

To sample a stack before opening may be required for forward planning for ration formulation, selling of silage, determining the amount (and quality) in storage, etc.

The accuracy of this sampling will vary depending on the way the stack was built (horizontal layers vs Dorset wedge), whether part of the stack is rain affected or not, whether single or multiple species were ensiled, whether filled in one day or over several days, etc.

The plastic seal will need to be slit but only enough to allow entry of a corer. A simple and cheap corer can be constructed from milk line or air stainless tubing (see figure 1). The corer should be long enough to sample through most of the storage depth. Cores should be taken over the entire length of the stack.



Figure 1. Simple corer made from stainless steel tubing

Avoid including the first 30 cm of the stack top as this most likely will be of different DM (and quality) due to less compaction, and effected by the timing and efficiency of the final sealing. Avoid the edges for the same reasons.

Avoid sampling where rainwater has collected in depressions on the plastic sheet and especially keep well clear of any holes.

Reseal the plastic sheet as soon as possible after sampling, using plastic tape specifically designed for silage plastic (see figure 2). The area surrounding the hole should be clean, dry and not hot to ensure a proper seal.



Figure 2. Plastic tape lifting due to poor preparation

During feed out

If the stack is being fed out, collect twelve grab samples from a freshly cut face. This will represent the DM (and quality) of the surrounding material only. If the stack varies for any of the reasons given above, then regular sampling will need to occur.

Avoid sampling near the top of the stack, sidewalls, and near the storage bottom if the material was slightly too wet at ensiling. Avoid any areas affected by holed plastic.

5. Baled silage and hay

Use the same sampling regime for silage and hay. Sample 10 – 12 bales in each batch of bales using a corer. Sample to the centre of the bales through their circumference or round sides (see figure 3).

Grab sampling from a fed out windrow can result in widely variable results due to inaccuracy of sampling, loss of leaf and less bales being sub sampled.

For a more representative sample, small square and large rectangular bales should be core sampled from their ends.



Figure 3. Sampling a round bale of silage

Patch the plastic stretchwrap as soon as possible after coring, using plastic tape specifically designed for silage plastic. Ensure the area surrounding the hole is clean, dry and not hot to ensure a proper seal.

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