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Silage Analysis for Dairy Cattle; Getting the Most out of Your Grass



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Dry matter (DM) represents the proportion of total components remaining *after* water has been removed. The lower the DM of forage, the higher the fresh weight needed to achieve a target intake.

DM intake is influenced by feed composition and body weight; A typical holstein/friesian cow eats 3-3.5% of their body weight in DM every day (for example a 600kg cow has a DM intake of 18-21kg/day). Dry cows require a lower DM/day (2% of their body weight), whereas high producing cows require a higher intake (over 4% of their bodyweight). If the silage is too wet (below 25% DM), it will be hard for cows to eat enough to meet their nutritional needs.

Digestible energy (DE) is a measurement of total energy (calories) in feed *minus* the energy lost in faeces.

The DE can be a misleading value, not actually taking into account the digestibility of the feed. The higher the DE value, the more energy dense the forage. A dairy cow's daily energy requirements depend on specific needs for maintenance, reproduction, milk production and body condition score, a more accurate representation of energy requirements is the metabolisable energy (below).

Digestibility (D-value) is the percentage of digestible organic matter in the DM proportion of forage. Differences in digestibility of grasses are influenced by leaf/stem ratios.

As plants mature, the stem is an increasing percentage of the total herbage and hence reduces the D-value; the onset of stem formation and heading reduces the D-value by 0.5 units/day. A D-value of 70% is ideal, and reduces the need for concentrates in the ration. Lower D-values are reflected by a lower utilisation of nutrients.

Metabolisable energy (ME) is the energy an animal can derive from feed. The ME value is directly correlated with the D-value because grass must be digestible in order for the energy to be available. 1% D-value = 0.16MJ/Kg DM of ME.

The ME value of silage is largely dependent on the sward maturity; Young leafy grass has the highest ME value (~11.5MJ ME/Kg DM), where as stemmy mature grasses cut at post-flowering stage have a

low ME value (potentially 7MJ/kg DM). Good quality silage should be over 10MJ ME/Kg.

Typical dairy cattle require 10% Body weight + 10MJ energy each day for maintenance.

Eg. a 600kg cow would need 70MJ ME/day. ME requirements increase by a further 40% during gestation. During lactation, ME requirements are dependent on milk fat and protein percentages and yield (the higher the yield and quality, the higher the energy requirements).

Crude protein (CP) is a measurement of the protein *content* (not protein quality!)

Ruminants aren't effective utilisers of protein; as it enters the rumen it is partially broken down by rumen microorganisms to ammonia and carbon fragments. Only some of the protein will bypass rumen degradation, entering the small intestine where it is digested as amino acids. As a rule of thumb, cattle require a higher level of protein in their diet to account for losses, and requirements increase with increasing milk production. Aim for a silage CP value of 17-18%.

Neutral detergent fibre (NDF) is a measure of the fibrous components of plant cell walls, cellulose, hemicellulose and lignin. Hemicellulose is digestible by rumen microbes, therefore the **acid detergent fibre** (ADF) measures just the non-digestible parts of the cell wall, cellulose and lignin.

Fibre is essential for promoting saliva production, rumination and the production of rumen microbes. NDF and ADF increase as the plant matures; too much fibre reduces fermentation leading to reduced dry matter intake, whilst too little can allow fermentation to occur too rapidly, causing acidosis. Looking at the heading dates of the grass mix should aid in ensuring a good fibre content. Aim for an NDF value of 40-50% (400-500g/kg DM) and an ADF value of around 30% (300g/kg DM) to ensure a good fermentation.

Water soluble carbohydrates (WSC) measures simple sugars and fructan levels.

Water soluble carbohydrates are an important energy source for rumen microbes responsible for digesting silage. They are also the primary substrate for fermentation of silage; if the WSC content is too low, fermentation is slowed and the pH is not low enough to deactivate harmful bacteria. Primary WSC include glucose, fructose, sucrose and fructans. 3% WSC in fresh grass is required for good quality silage.

Ash is a measurement of *total* mineral content of forage. The evaluation of ash is based on determining whether ash levels are intrinsic (from minerals in the plant) or from soil contamination.

Aim for a silage ash value of below 8%. If forage is contaminated with soil, a high ash value (above 10%) is usually accompanied with a high iron value (>10%) and low ME value. Listeria bacteria thrive in soil and are easily picked up at harvest. It thrives in silage with high oxygen (from poor ensiling or a high DM). Bovine iritis (silage eye) is caused by Listeria infection. It should be noted, legume silages will have a slightly higher ash percentage due to higher mineral content.

pH is an important measure in conserved forage, it creates an environment where moulds and fungi cannot grow.

The ‘pickling’ process of silage takes 8-10 weeks. Fermentation of grass relies on the exclusion of oxygen; after a few days of being ensiled, the environment becomes anaerobic. Bacteria (primarily *Lactobacillus spp*.) use carbohydrates in the forage, producing lactic acid as a byproduct. This causes the pH of the bale/clamp to drop to a stable level where microbial activity is limited. Well fermented silage smells fruity.

Well fermented silage should smell fruity with a pH level of 3.8-4.2. A high pH indicates restricted fermentation due to restricted lactic acid. This may be due to a low DM, insufficient WSC in the grass, or an aerobic environment. The pH will not be low enough to prevent the growth of undesirable moulds and fungi. However, too low pH (below 3.7) indicates fermentation may have been dominated by acid-tolerant lactic bacteria, impairing rumen function, leading to acidosis.

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