

GRASSLAND DEVELOPMENT CENTRE CANOLFAN DATBLYGU TIR GLAS

407.02 INTERPRETING GRASS SILAGE ANALYSIS

Silage analyses are carried out by a number of commercial and feed company laboratories. They all adopt their own methods of analysis and format but the most common and important features of the analysis are likely to appear in most reports. This factsheet defines the terms used with the range of values likely to be found and suggested targets for a well made and high quality silage. The ideal silage quality may vary with the class of livestock it is intended. Most items of analysis are reported either as g/kg of DM or as % of DM.

SILAGE SAMPLES

1. Wait at least six weeks after harvesting before sampling silage, to ensure fermentation has completed.
2. Send your sample in for analysis early in the week.
3. If possible vacuum pack sample, or pack into a polythene bag as tightly as possible and squeeze as much of the air out before sealing tightly. This will help reduce silage changes in the post and make your analysis more meaningful.
4. Give the analytical services as much information on your silage as possible. (eg. crop type grass, red clover/grass mixed sward. 1st, 2nd or 3rd cut. Bale or clamp. Additive used). This information will help them decide which calibration equations they will use to analyse your silage and so give you better analysis.

DEFINITIONS

Dry matter (DM) - The amount of material left after all the water has been removed by drying (in a forced-draught oven at 100°C for 18h). Values usually given are 'corrected values' to allow for volatile fatty acids and other components lost on oven drying.

D value - Is the content of digestible organic matter in the DM.

Metabolisable Energy (ME) - Is a measure of the energy value of the silage when fed to ruminant livestock.

Fermentable ME (FME) - FME is the portion of ME that is able to supply energy to the rumen microbes and effects the amount of non-protein nitrogen that can be utilised. It excludes fat or oil & volatile components eg volatile fatty acids.

Neutral detergent fibre (NDF) - Is a useful indicator of forage intake potential, which declines with increasing NDF values. A certain level of fibre intake is important in determining good rumen function. The NDF residues include hemicellulose, cellulose & lignin.

Acid detergent fibre (ADF) - Is a measure of the cellulose and lignin content of the silage. Can be used to estimate digestibility.

Ash - indicates the mineral content of the silage. A high value (>100 g/kg DM) indicates soil contamination, which will reduce intake and is likely to have resulted in a silage with poorer fermentation characteristics such as higher acetic and butyric acids and ammonia. High ash content in legume silages is normal due to their high mineral content.

Crude protein (CP) - It is determined from the total nitrogen (N*6.25) content of a silage and is mainly related to the crude protein content of the herbage going in minus any effluent losses. Its main purpose is to show whether there is sufficient protein available for the rumen micro-organisms. However, this figure tells you nothing about the quality of that protein which can have a significant effect on animal performance.

Soluble protein or Soluble nitrogen (N) - The soluble N is the proportion of total N, which is soluble in hot water. It shows the non-protein-nitrogen (NPN) content eg amino acids, amines, ammonia and is an indicator of silage intake. The value should be as low as possible.

Amino acid N (proportion of soluble N) - Amino acids are the components of true protein. It is another indicator of silage intake. The value should be as high as possible.

Protein degradability - A low value indicates that very little protein is broken down in the rumen and is a desirable characteristic.

pH - This indicates the amount of acid in the silage. Low values indicates the high acidity required for stable silage fermentation. With increasing DM well fermented silage may be achieved at higher pH levels.

Maximum pH required to produce well fermented silage at different ranges of DM

DM range (g/kg)	<180	180-200	200-220	220-240	240-260	260-280	280-300	>300
pH required	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.8

Ammonia Nitrogen (NH₃)^N - It shows the proportion of N (including protein) that has been broken down during ensilage and is the best indicator of silage fermentation. A value <50 g/kg N indicates an excellent fermentation, a stable silage and minimal nutrient loss. Values >150g/kg indicate a poor fermentation.

Total fermentation acids (TFA) - the total amount of acid produced during fermentation.

Volatile fatty acids (VFA) - High levels of these acids shows a poor fermentation. The undesirable VFA's are butyric and, to a lesser extent acetic acid which are associated with high total VFA and give a distinctive and persisting smell to badly made silages.

Lactic acid - High lactic acid values show increased efficiency in conversion of WSC to acid. It needs to be interpreted in relation to TFA content. In a well fermented silage lactic acid should comprise at least 75% of the total VFA's.

Acetic acid - Is looked upon as a normal constituent of silage, but less desirable than lactic acid. High levels can restrict intake.

Butyric acid - The production of butyric acid indicates poorly fermented silage. This can be produced under anaerobic conditions due to a variety of factors including high soil contamination, slow rate of fermentation, low DM content and secondary fermentation.

Residual sugar RS (WSC) - The amount of residual sugar is important, because it is a valuable source of readily available energy for rumen microflora.

Ethanol - Ethanol production in silage should be very low, because it is associated with the growth of undesirable yeasts that could cause heating during feeding.

Intake potential - This uses all the analyses to indicate potential silage intake.

Better quality silages with low acetic, ammonia-N, butyric and high lactic and sugars are more prone to aerobic spoilage and thus need to be managed correctly to avoid losses during feedout.

TYPICAL & TARGET VALUES FOR GRASS SILAGE

Analysis	Abbrev	Units	Range	Target value
Dry matter	DM	g/kg	150-500	270-300
D value	'D'	%	55-75	>68
Metabolisable energy	ME	MJ/kgDM	8.8-12.0	>11
Fermentable ME	FME	MJ/kgDM	0.5-0.8	FME/ME >0.70
Neutral detergent fibre	NDF	g/kgDM	500-650	500-550
Acid detergent fibre	ADF	g/kgDM	230-350	300
Ash		g/kgDM	60-200	<80
Crude protein	CP	g/kgDM	100-200	150-175
Soluble protein	solCP	g/kgDM	0.25-0.75	0.3-0.5
Amino acid N		g/kg total sol N	0.4-.0.8	>0.75
Protein degradability		%CP	50-90	50
pH			3.5-5.5	Depends on DM
Ammonia N	NH3N	g/kg N	20-300	<80
Total fermentable acids	TFA	g/kgDM	20-200	<100 (depends on DM)
Volatile fatty acids	VFA	g/kgDM	10-90	%TFA 25% (as low as possible)
Lactic acid		g/kgDM	20-200	80-120
Acetic acid		g/kgDM	20-80	<25
Butyric acid		g/kgDM	0-20	<5
Residual sugars		g/kgDM	0-150	100 (as high as possible)
Ethanol		g/kgDM	0-20	<10
Intake potential		gDM/kg*W ^{0.75}	45-120	100

* For well fermented silage lactic acid as the proportion total acids should be >75%

FURTHER INFORMATION

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