FaneValley | AgriAdvance

Silage Guide

Introduction

Silage plays a crucial role in livestock farming in Northern Ireland, serving as the primary conserved forage for ruminants during the winter months and increasingly throughout the year. It provides a reliable and nutrient-rich feed source when fresh pasture is unavailable.

The seasonal nature of grass growth in Northern Ireland necessitates effective integration of grazing and grass conservation to fully manage and utilise grass within meat and milk production systems. High-quality silage is essential for maintaining animal health, milk production, and overall farm profitability. Research has shown that each unit increase in silage digestibility (D-value) can increase milk yield by 0.3-0.4 litres per day, highlighting its significant impact on livestock performance. Furthermore, well-made silage retains a high level of nutrients, offering more energy and protein compared to hay, which is particularly important for autumn and winter calving dairy cows where concentrate supplementation can substantially add to production costs.

Fane Valley are committed to helping your business grow the best quality grass silage for your livestock's requirements and this guide alongside our Forage Improvement Programme will help you to grow better quality forage.

Gary Spence

Gary Spence
Technical Support Manager
Grassland

What is Good Quality Silage?

Good silage is dependent on the class of livestock you are feeding as what is good silage for high producing dairy cows is very different to good silage for dry suckler cows. Quality targets should be set for the class of stock you intend to feed, and a plan put in place to hit these targets.

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Stock Class	Fresh Autumn Calved Dairy/ Finishing Cattle	Fresh Autumn Calved Dairy/ Finishing Cattle	Spring Calving Cows in Milk/ Growing/ Finishing Cattle	Growing Cattle/ Suckler Cow in Milk	Dry Cows poor condition/ Growing Cattle	Dry Cow Good condition		
D-Value	75.0	73.0	71.0	69.0	67.0	65.0	61.5	54.5

Cutting Date

Cutting date has a significant impact on silage yield and quality. As the crop starts to bulk up and yield increases, quality declines as the grass begins to produce stems and heads. These are less digestible than leafy growth. Optimum cutting date is influenced by the class of stock the silage will be fed to.

As a rule, D-value falls by 0.5 units a day from when the grass starts to push up flowering stems. Fresh grass analysis can be useful to provide an estimate of D-value, nitrate N and crude protein. However, the sugar analysis will not resemble that in the field at cutting because it changes considerably from hour to hour and day to day, depending on the weather.

Date of cutting	01 May	08 May	15 May	22 May	29 May	05 Jun	12 Jun	19 Jun	26 Jun
Grass yield (t DM/ha)	2.92	3.99	4.98	5.96	6.79	7.82	8.48	8.89	9.5
D-Value	75.0	73.0	71.0	69.0	67.0	65.0	61.5	58.0	54.5
ME (MJ/kg DM)	13	11.7	11.3	11.0	10.7	10.4	9.8	9.3	8.7
Regrowth	Very Fast	Fast	Good	Average	Average	Slow	Slow	Very Slow	Very Slow
Cutting interval (days)	28-35	35-42	35-42	42-50	42-50	50-62	63+	63+	63+

Importance of the Correct Species

Perennial ryegrass (PRG) is a crucial component for producing high-quality grass silage, offering numerous benefits to farmers and livestock. Its superior digestibility and consistent production make it an excellent long-term option for silage production. The high sugar content of perennial ryegrass aids in the fermentation process. Perennial ryegrass responds well to fertiliser application and is highly palatable to livestock, combining good production with excellent persistency.

Effect of PRG content on production and energy content of a sward

PRG Content %	Production (T DM/ha)	Herbage ME (MJ/kg DM)	Lost ME grown (MJ/ha)	Milk equivalent of lost ME (litres/ha)
95	13.5	12	-	-
90	12.6	11.8	13,320	1,885
80	11.2	11.5	33,200	4,698
70	9.8	11.3	51,260	7,254
60	8.4	11	69,600	9,849
50	7	10.8	86,400	1,226

Nutritional value and yield of differing grassland species

Species	ME (Mj/kg DM)	Crude Protein (% in DM)	Yielf Potential (T DM/ha)
Perennial ryegrass (PRG)	11.7+	16-25	13+
Timothy	10.9	14-20	10+
Annual Meadow Grass	9.0	<15	4.5+
Yorkshire Fog	9.8	7-14	5-7
White/Red Clover	12	18+	4-12+

Cutting

Mow after the dew has dried off. Plants contain higher sugar levels in the afternoon. A rapid wilt concentrates the sugars, allowing a quick and effective fermentation.

- A conditioner on the mower splits the grass, so there is a greater surface area for water loss. This can increase wilting speed by up to 20%.
- Leave a stubble of at least 5cm to (7-8cm if multi-cut or red clover swards) allow air movement beneath the lying grass.
- Spread the crop quickly and over a wide area. Water loss is highest for the first two hours after cutting.
- Ensure rakes and tedders are set at the right height so they work efficiently and do not pick up soil or manure.
- Wilt as rapidly as possible for a maximum of 24 hours. Crops with high amounts of clover can be wilted for 48 hours.
- Row up into even ‘box-shaped’ swaths immediately before pick-up or baling.

Chop Length

Chop length is important to fermentation, clamp stability and rumen passage. Too long a chop makes it difficult to remove air from the clamp particularly in higher DM silages and can lead to sorting of the diet if fed to cattle in a TMR. However, if the grass is chopped too short it can lead to poor rumen function and increased risk of slippage.

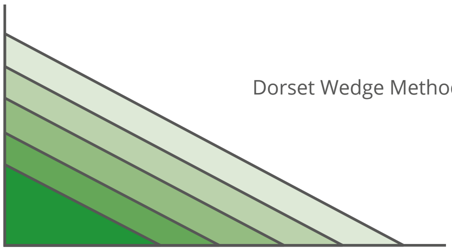
Dry Matter	>30%	20-30%	<20%	30% & 73+ D-Value
Chop Length	2.5cm	2.5-5cm	5-10cm	3.5-5cm

Clamp Filling

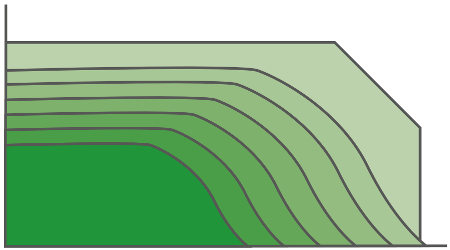
Make sure that the clamp has been thoroughly cleaned to avoid contamination which could inhibit fermentation. Best practice to use side sheets to ensure a good seal and prevent waste at edges this will also protect concrete. Ensure you leave the sufficient sheeting at the top to enable a good overlap side sheets should overlap with the top sheet by at least 2m.

Two main methods of clamp filling the Dorset wedge or layering. Either way the clamp should be filled in layers no more than 15cm deep as anymore is very challenging to compact. The Dorset Wedge is the traditional method of clamp filling Where a steep ramp is created to maximise effectiveness of rolling, with this system air exposure is minimised during filling and if reopening the clamp for subsequent cuts. The newer method of layering fills the clamp in layers the whole length of the clamp which maximises the area for compaction. It also allows for a more space on the clamp for multiple machines to work. This system also reduces risk of slippage and gives more consistent feed quality when feeding out as each cut can be fed simultaneously.

Seal the clamp immediately after filling, even if this is late at night. Pull the sheet over and place sufficient weight to hold the sheet down overnight. Use a quality sheet and consider an oxygen barrier. Ensure the sheet is well weighted when sealing particularly around edges.



Dorset Wedge Method

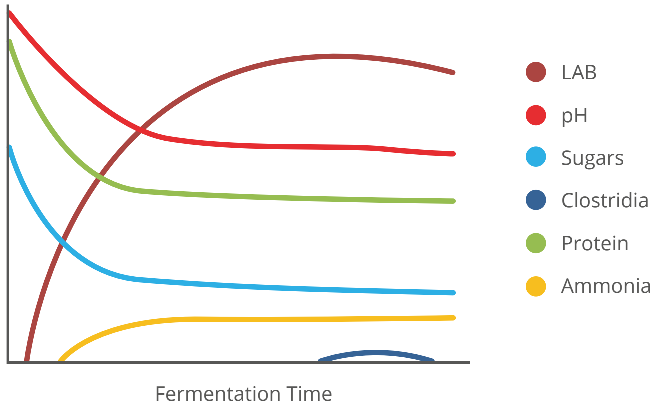


Layering Method

Fermentation Process

The silage fermentation process is a complex series of stages that occur when forage crops are preserved through anaerobic conditions. It begins with an aerobic phase lasting a few hours, where plant respiration consumes oxygen and produces heat. Once oxygen is depleted, the process enters an anaerobic phase where lactic acid bacteria (LAB) dominate, converting water-soluble carbohydrates into organic acids, primarily lactic acid.

This fermentation phase can last several days to weeks, during which the pH drops to around 3.8-5.0, inhibiting spoilage microorganisms. As fermentation progresses, the temperature stabilizes, and the silage enters a stable phase where fermentation activity slows down. The entire process typically takes about two weeks to complete, resulting in preserved forage with a low pH that can be stored for extended periods.



pH

Normally 3.8 to 4.2, pH measures the silage acidity and so the ability of the silage to store. Reduced intakes can occur with too low a pH while a high pH in low dry matter silages can be an indicator of poor fermentation. The faster the pH value falls the sooner the wasteful activities of the live plant material and undesirable microorganisms will stop. This will reduce losses and result in a more palatable silage. It will also conserve more sugars for conversion to lactic acid so that less sugars will be required to achieve a successful fermentation.

If the pH is slow to fall and/or sugars run out before a stable pH is reached, undesirable microorganisms such as clostridia can take over as they can convert lactic acid to butyric acid, a much weaker acid, so the pH increases (clostridial secondary fermentation). Too low a pH is not desirable however as it is difficult for the animal to maintain a stable rumen pH of 6.5.

Dry Matter %	18-20	20-24	24-26	26-30	30+
Target pH	3.8	4.0-4.1	4.2	4.3-4.4	4.8

Lactic Acid

Lactic acid should be the primary acid in good silage. This acid is stronger than the other acids in silage (acetic, propionic, and butyric), and therefore is usually responsible for most of the drop in silage pH. Further, fermentations that produce lactic acid result in the lowest losses of DM and energy from the crop during storage. Whilst lactic acid is excellent for fermentation it is a poor spoilage inhibitor.

Some common reasons for low lactic acid content include the following.

- Restricted fermentation due to high DM content (especially legumes and grasses with >50% DM).
- Restricted fermentation due to cold weather.
- Sample taken after considerable aerobic exposure that has degraded lactic acid.
- Silages high in butyric acid (clostridial silages) are usually low in lactic acid.
- Lactic acid should be 80-120g/kg at least 65 to 70% of the total silage acids.

Acetic Acid

Wet silages (<25% DM), slow fermentations (due to high buffering capacity), loose packing, or slow silo filling can result in silages with high concentrations of acetic acid (>3 to 4% of DM). In such silages, energy and DM recovery are probably less than ideal. Silages treated with ammonia also tend to have higher concentrations of acetic acid than untreated silage, because the fermentation is prolonged by the addition of the ammonia that raises pH.

Lactobacillus buchneri designed for improving the aerobic stability of silages causes higher than normal concentrations of acetic acid in silages. However, production of acetic acid from this organism should not be mistaken for a poor fermentation and feeding treated silages with a high concentration of acetic acid does not appear to cause negative effects on animal intake.

Butyric Acid

Butyric acid is a volatile fatty acid, such as acetic acid and propionic acid, with a very pungent odour, likened to sweaty feet or strong cheese-like smell, and an unpleasant taste. Butyric acid is produced by butyric acid bacteria in poorly preserved silage. The smell of butyric acid is therefore characteristic of poor, wet grass silage. The formation of butyric acid can be largely prevented by compacting the silage well, wilting, covering it quickly and using silage additives.

Butyric acid bacteria are anaerobic bacteria of Clostridium and are naturally abundant in water, soil, and manure. Butyric acid bacteria are spore-forming bacteria. Spores are bacteria that are in a so-called resting state and are very resistant to drought, heat, and other extreme conditions. In this way, they can survive for years and germinate again into harmful bacteria under favourable conditions.

Silage Inoculants

Two main types of bacterial silage inoculant, the traditional homofermentative types, such as Lactobacillus plantarum, the Pediococcus species, and Enterococcus faecium; and the more recently used heterofermentative bacteria, Lactobacillus buchneri. Many of the new products combine the two types of fermenters to improve fermentation and stability.

Homofermenters turn sugar molecules into lactic acid. Heterofermenters produce multiple products, they can turn sugar into lactic and acetic acid. The inoculant used should depend on the goal and the challenges faced by that crop/farm management. If you want to preserve crop quality as close as possible to that of the crop at ensiling, use an inoculant that maximizes lactic acid production, a homofermenter. If you want silage that doesn't heat, use an inoculant that produces acetic acid, which is the heterofermenter, L. buchneri. A combination product can give the best of both.

Wetter silage will benefit from higher counts of homofermentative bacteria due the need for a rapid pH drop, whereas drier silage will benefit from heterofermentative bacteria due to the higher challenges with aerobic stability at feed out due to acetic acids ability to prevent the growth of yeasts and moulds.

Enzymes Improve silage fermentation sugar is limiting by making sugar more soluble sugars and provide feed for bacteria. Several studies have reported reductions in neutral detergent fibre (NDF) by using enzyme-based silage additives.

The Fane Valley range of silage additives from Lallemand and Pioneer are high quality additives with products to meet your needs aiding in a fast efficient fermentation even under challenging conditions.

Trial data on the use of silage inoculants

Magniva Platinum	Axphast
29% reduction in dry matter loss	50% less effluent
1.5kg higher dry matter intake	19% improvement in fibre digestability
1.9kg increase in fat corrected milk yield	1.26kg increase in milk yield
4.3% increase in milk fat	7.8% increase in milk fat
2.9% increase in milk protein	2.4% increase in milk protein

Dry Cow Silage

Making specialist dry cow grass silage requires careful planning and execution to achieve the desired nutritional profile. Dry cow silage should have lower potassium to prevent milk fever and other metabolic disorders in cows after calving. Ideally use fields with lower soil potassium levels and avoid using slurry or fertiliser containing potassium on grass intended for dry cow silage. It can be difficult to consistently make grass silage with the correct mineral profile for dry cows and buffering cows with maize silage or wholecrop cereal silage can be beneficial.

Potassium (K)

- Ideal content: No more than 1.0% of dry matter
- Target: Less than 1.5% of dry matter intake (DMI)

Forage Improvement Programme

The Fane Valley AgriAdvance forage improvement programme has been designed to advance soil and plant health on livestock farms to maximise forage production and utilisation.

The programme is specially designed to support the grassland and forage farmer to increase production to become more efficient, more sustainable and ultimately more profitable by:

1. Increasing forage production per hectare.
2. Improving forage utilisation.
3. Increasing milk yield or meat yield per hectare.

On joining the programme, a dedicated agronomist from the Fane Valley Agronomy and Forage team will be assigned to the farm business and will visit the farm regularly. The programme starts with a full farm and forage audit to baseline current forage production, grassland condition, soil health, soil nutrient status, and forage production requirements.

The forage improvement programme will focus on making your farm more sustainable and profitable through the optimal production of high-quality grazing, grass silage, specialist dry cow silage and alternative forages including maize, wholecrop and root crops. The AgriAdvance approach is holistic and based on scientific principles, it will make use of analytical data and digital tools to complement the expertise of agronomists in field to make recommendations to you to improve forage production from your land. Bespoke improvement plans will be developed for the farm business.

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