DN TECH BRIEF

Managing your forage

Managing silage production systems to reduce losses and to produce a high quality forage.

Dugdale Nutrition

Introduction

Grass silage can account for 20-25% of total yearly feed on dairy farms and up to 30% on a beef farm depending on the production system used. Producing a good quality silage with limited losses is therefore key in supplying animals with a high quality forage based diet during winter and housed periods. The aim of this guide is to provide information outlining where and why nutritional losses occur and the best practice when it comes to managing the silage production process.

Contents

The Basic Process of Making Silage

Silage making is one of the most important processes to occur on farm that every farmer will be involved in. It is the process of preserving a forage using the lactic acid that is produced as a by-product by naturally occurring bacteria found on the fresh crop. The two main areas of the process are harvesting and ensiling (where the fermentation occurs). Below the two processes have been briefly outlined.

Harvesting

When it comes to harvest the crop preparation is key. If you are harvesting it yourself, making sure machinary is well-maintained and ready to go. This can help reduce costly breakdowns occurring at curtail times during harvest.

Once the crop has been cut, as much of the swath needs to be exposed as possible. This can be achieved by turning or spreading. This allows for the crop to dry rapidly, which will reduce the nutrients lost and growth of unwanted micro-organisms which occurs as soon as the crop is cut. This rapid wilting will help to reduce contamination and spoilage later on within the clamp/bale.

Chopping the crop at this stage is also important in having a quicker and more efficient fermentation. Below are the recommendations for chop length depending on dry matter (DM) of the crop.

DM (%)	Chop length (cm)
20 or less	2.5+
20-28	2.0-2.5
28-35	1.3-2.0

***IGER** recommended chop lengths*

Ensiling/ Fermentation

Once the crop is cut and wilted it is then either baled or bought into a clamp. This is when the process of fermentation occurs to ensile the crop and produce silage.

Aerobic Stage (air present)

- Lasts a few hours after ensiling and the crop is sealed
- Oxygen levels start to deplete

Fermentation stage

- Lasts between 2-3 days, plant material and micro-organisms converted most of Oxygen to CO_2
- Lactic acid bacteria start to dominate

Fermentation stage/ stable stage

- Occurs after approx. 7 days, clamp becomes completely anaerobic (no air)
- pH is stable around 3.8-5 dependent on DM
- Lactic acid bacteria dominate and fermentation is now complete

Opening the clamp

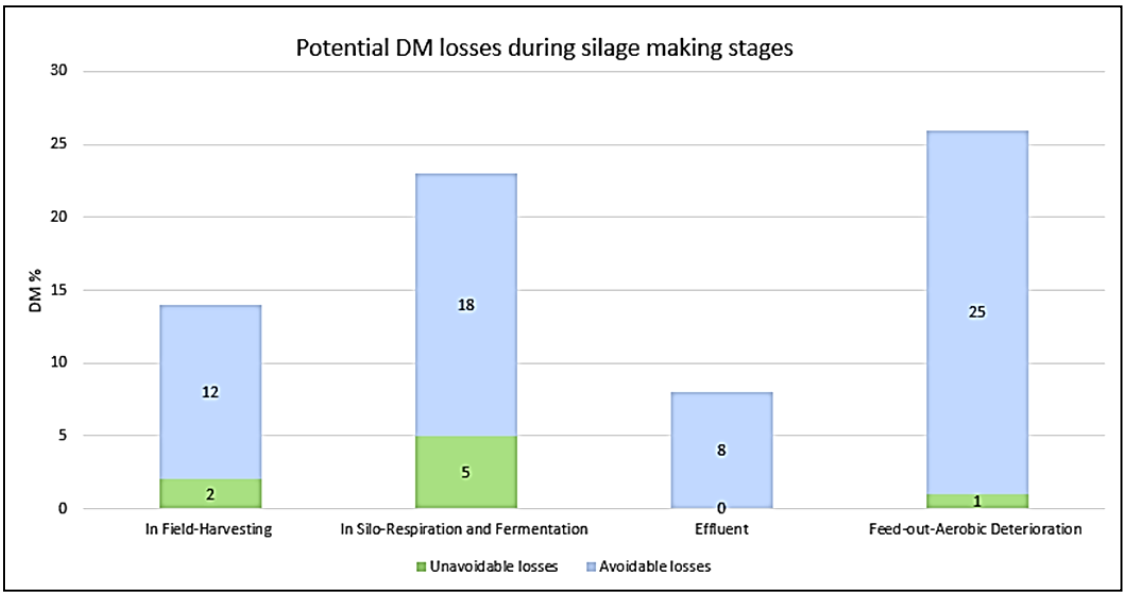
- When the silage is exposed to air, dormant aerobic organisms present will become active again
- Good management of clamp face can reduce the impact of yeast, mould and aerobic spoilage

DM Losses During Silaging

Losses in nutritional value can occur at any point in the ensiling process right from cutting through to feeding out. Understanding where and why these losses occur can help to manage and change these areas to help improve the quality and reduce the losses seen within the crop.

Losses of dry matter (DM)

DM is an important nutritional component of silage. It has an influence on the overall quality and digestibility of the forage. DM losses are normally made up of other valuable nutrients within the forage including sugars, starches and soluble proteins. DM can be lost at any point during silage making, the graph below highlights key areas where losses can occur (unavoidable and avoidable).

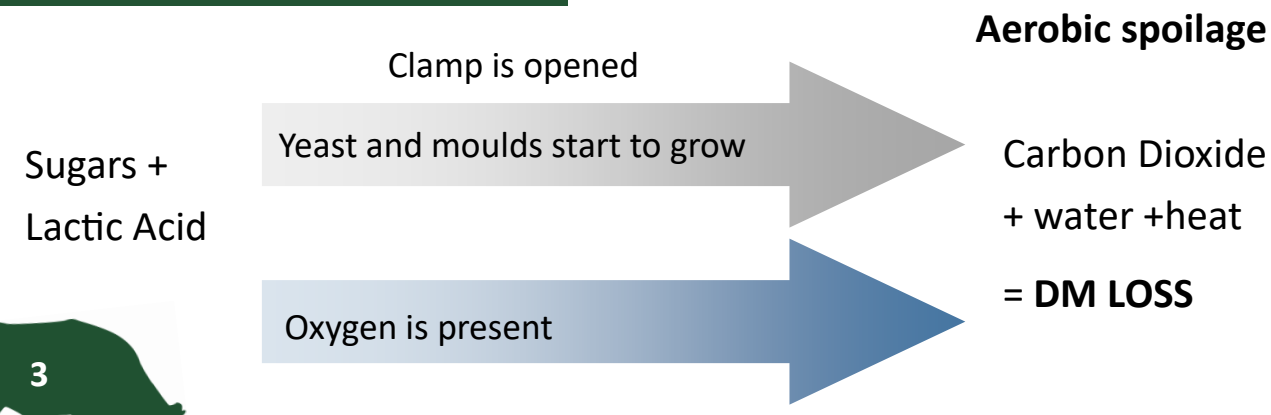


(Source: IGER, not dated)

DM losses at feed-out

Spoilage occurs when the clamp is opened and in contact with air. This is sometimes referred to as 'secondary fermentation' but it is not part of the fermentation process as it only occurs with the presence of oxygen. Air can penetrate into the face by 1m and at this depth oxygen concentration can be at 2.5%. This is sufficient for yeast to multiply using residual sugars and lactic acid. The yeast converts these nutrients to carbon dioxide and water, this process produces a significant amount of heat which results in high losses of DM. Moulds can also start to grow at this stage.

Aerobic spoilage



Losses in the Clamp

Losses at clamp face

Not only can losses occur when the silage is being harvested, but once it has completed the fermentation process and it's time to open the clamp, often visible loss is seen in the form of mould. Unseen losses also occur at this stage at the clamp face once the silage is in contact with the air.

- Multi-cut systems in areas which produce wetter silages can increase the likelihood of visible spoilage occurring– lack of fibre makes compaction harder and fermentation more aggressive resulting in a less stable silage and increased chance of slippage.
- Wet-dark green silages suggest young grass has been cut, which contains high levels of N and its low in water soluble carbohydrates. This results in limited 'positive' fermentation and the potential production of toxic gases– Nitrous Oxide

Problems seen

Problem	Cause
Rancid, fishy odour. Sticky and slimy texture	**High butyric acid levels due to :** • Soil contamination • Late manure application • Low DM of forage (<30%)
Visible mould – silage has a musty odour	**Presence of oxygen due to:** • Poor filling and sealing of the clamp • High DM (>35%) • Poor feeding out management
Smells like tobacco, looks orange brown in colour	• Poor consolidation in the clamp • Not sheeting overnight when filling takes longer than a day • Too high DM causing excessive heating in the first few days after sealing
Smells like vinegar	• Acetic acid fermentation has occurred due to high levels of unwanted bacteria
Sweet smelling	• High levels of ethanol produced by yeast (also some acetic acid)
Ammonia odour	• Excessive protein being broken down into ammonia or high pH

(Adapted from: AHDB, 2015)

Ensiling Method– Big Bales vs Clamp

The choice and method of ensiling will depend on availability of clamp space, contractor, equipment available, amount of silage being made and the feeding system. Whether silage is made into big bales or stored in a clamp will not only be down to space available but also personal preference and farm management system. If managed well the quality of big bale silage can be the same of that which is stored in a clamp and fermentation losses within big bales can be half of that reported in clamps.

Big Bales

The principles of making big bale silage is the same as clamped silage. Aerobic spoilage tends to be lower due to the bales being individually wrapped. They can be more economical compared to clamped silage due to the lower levels of wastage resulting in more efficient utilisation of forage and better returns from animal productivity.

Pros	Cons
• Low aerobic spoilage	• Not suitable for very wet silages– spoilage
• Flexibility when cutting– cut at optimum date for each field	• Labour intensive when feeding out
• Target the quality the livestock needs	• Risk of variation in quality between bales/ fields
• Good for storing extra crop– especially of later cuts	• Prone to damage from machinery, birds, vermin which leads to spoilage
• Low DM losses (<5-10%) during production and storage	• Disposing of plastic– environmental issue
• Limited capital investment– low storage	• High cost per unit

Clamp

Clamped silage systems are generally a quicker way of harvesting a large area of grass, although infrastructure and machinery is needed for this method which can be costly.

Pros	Cons
• Large scale operation allows for harvest to happen quickly	• Depreciation cost of the clamp
• More consistency in quality for each cut	• Higher DM losses that in bales (25% vs 8%)
• Suitable storage for a range of DM's (up to 40%)	• Heating, mould and aerobic spoilage occurs at the face when feeding out

Pointers for Success at Harvest

Harvesting

When harvesting grass, it requires a balance of quality and quantity. As the growing season progresses the quality of the grass depletes but the quantity increases. Therefore optimising the grass available is key to try and get the best out of the crop as possible.

- Avoid late fertilisation application, apply Nitrogen 8 weeks prior to cutting
- Do not slurry within 10 weeks of harvest, reduces risk of micro-organism contamination
- Target for a chop length of 2cm and if possible multi-cuts can be taken
- Cut late morning/early afternoon to maximise sugar content
- Cut 10cm + (from ground) to avoid soil contamination or higher or uneven field
- Test grass before cutting, aim for 2.5% sugar (min) and if nitrate-N levels are greater then 0.1% do not cut

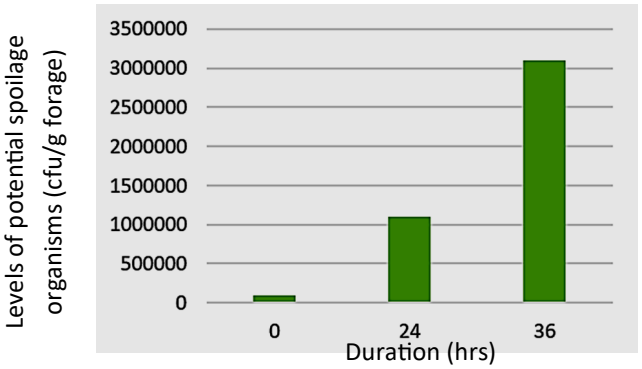
Wilting and Tedding

- Aim for a rapid wilt (24hrs max) to allow grass to reduce to 25-30% DM– reduces effluent and concentrates sugar content
- Crop can be laid out to aid in the wilting process, helps to maintain more of the feed value from fresh grass into the silage
- A guidance of 1% moisture is lost per hour of wilting in bight sunny conditions
- Take care when tedding not to rake up soil– causes contamination within the silage once ensiled

Optimal Chop length and DM for other silagable crops:

Crop	Target DM	Optimal chop length
Wholecrop	35-45%	2.5cm
Maize	30-35%	1.5-2cm
Lucern	30%	1-2cm

Effect of wilting on levels of spoilage organisms



(Source: Volac, not dated)

12 hour wilting has become standard practice to reach the higher DM needed within silage for modern day dairy cows. Longer wilting can result in the increased population of spoilage organisms such as coliforms which results in a loss of important nutrients and can increase spoilage within the clamp and bales. (shown in graph above).

Pointers for Success at Ensiling & Feed Out

Ensiling

Big Bales

Baling

- Aim for dense bales to produce heavier but fewer bales per hectare – minimises cost
- Wrap in netting that also covers the edge of the bale by 2-5cm – improves wrapping and reduced amount of O2 trapped

Wrapping

- Wrap as quickly as possible– preferably within 12 hours of baling
- Wrap at storage site or move to storage site as soon as wrapped– avoid leaving bales in the field as removing weeks later to storage site increases the chances of mouldy bales
- Use wrap with 55-70% pre-stretching

Stacking

- <25% DM stack one bale high
- 25-25% DM stack two bales high
- >30% DM stack three bales high
- Bales in the middle of the stack retain quality better so place best bales here
- Net bales for protection from birds and vermin (regularly inspect bales for damage)

Clamp

- Fill the clamp rapidly– spreading the silage evenly. If silaging continues the next day sheet down overnight
- The pressure put down under the wheels of the heavy vehicle rolling the clamp will only be effective down to a depth of 20cm
- Do not roll the following morning– this will create a vacuum which will pull air into the clamp
- Avoid making a large crown on the clamp and filling it too high– any silage that is filled over the walls will be harder to consolidate and compaction can be 10% less resulting in losses and waste
- Aim for 250kg DM/m3 or 750kg fresh matter/ m3, this can reduce DM losses, improve quality and reduces aerobic spoilage at feed out
- Cover and seal with two sheets of plastic (one thinner oxygen barrier and one thicker protective sheet) as soon as consolidation is complete.
- Weight down the top sheet with bales or tires

Feed out management

- Use a defacer/shear grab to keep the clamp face smooth which will reduce air penetration
- Some air will still penetrate the face so aim to cross the face within 2-3 days
- Aim to remove a minimum of 10cm from the face on a cold day and 30cm on a warm day
- Keep sheeting close to the feed face and remove and discard any spoilage
- For big bales, aim to have them consumed within 2 days at feed-out

Silage Additives

The purpose of an additive is to be correctly used on a good crop to improve fermentation, stability and animal performance, they can not make a bad silage good. If management during the silaging process is poor and a bad crop is produced, no amount of any additive is going to improve its quality

How they work and when to use

Additives are normally applied to the crop when it is picked up or baled. This is done by a specific applicator. Different products vary in what they contain and how they work, below is a summary of the different ones available

Type	How they work	When to use
Bacterial inoculant	**Homo-fermentative:** • Contains bacteria such as *plantarum, Pediococci* and *Lactococci* • Converts grass sugars and converts these into lactic acid which speeds up the fermentation process • Reduces ammonia– N, acetic acid, butyric acid and protein breakdown (higher levels of true protein) **Hetero-fermentative:** • Contains bacteria such as *L.buchneri, L. brevis* and *L.kefira* • Converts grass sugars to lactic and acetic acid, water and co2 • Used to improve aerobic stability at feed out **NOT** to quicken fermentation	High quality grasses with DM over 25% Late cut grasses High DM silage over 32% NOT on bales or low sugar crops
Enzymes	These convert the fibre in the silage to sugar so bacteria can then convert these sugars into lactic acid. Also help to improve D-vale of silage when fed.	Crops that are low in sugar
Acid e.g propionic	Directly acidifies the crop, inhibits yeast and moulds so can help with aerobic stability.	Low DM wet silages Crops low in sugar
Sugar supplements e.g molasses	Increases amount of sugar for lactic acid bacteria to convert to lactic acid.	High rates needed Crops low in sugar (often needed alongside a homo-fermentative inoculant)

Additives DN supplies

Dugdale Nutrition can supply a few different silage additives depending on what you need. These include additives from SiloSolve® and Advance®.

Please speak to your DN Sales Specialist for any more information regarding silage additives and how to mange your forage

Advance® SILAGE INOCULANTS

SiloSolve® FC

SiloSolve® MC

For further information regarding any of our products or guidance on managing your forage, please contact you local DN Sales Specialist or alternatively get in touch using the details below.

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