New Entrants to Farming Fact Sheet

Best Practice Procedures for Making Baled Silage

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Making forage is one of the most important management practices on the farm to feed livestock through the winter.

Baling silage is a significant cost to the farm business and therefore it is important to plan ahead to make the best quality silage that suits your system, minimising nutritional and financial losses along the way. Consideration must also be given to the environmental impact when making silage bales; how much do you need to make, how much wrap and net will be required and how best can that be recycled after use? This fact sheet details important steps to making quality baled silage.

Calculating Silage Requirements

This will be based on the type of stock and numbers and the length of the feeding period. Requirement can be calculated from the predicted dry matter intake of various stock as a proportion of their body weight (Table 1).

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Table 1. Silage requirements for various classes of stock.

Type of stock	Weight kg	Dry matter intake/ day kg (% of body weight)	*Fresh weight of silage/day kg (at 35% dry matter)
Dry suckler cow	600	9 (1.5)	25.7
Dry suckler cow	750	11.25 (1.5)	32.1
Lactating suckler cow	600	12 (2)	34.3
Lactating suckler cow	750	15 (2)	42.9
Weaned calf	300	7.5 (2.5)	21.4
Store	450	9 (2)	25.7
Finisher	600	10.8 (1.8)	30.9
Small ewe (late pregnancy)	50	1.0-1.25 (2-2.5)	2.9-3.6
Large ewe (late pregnancy)	70	1.4-1.75 (2-2.5)	4-5
Small ewe (early lactation)	50	1.5-1.75 (3-3.5)	4.3-5
Large ewe (early lactation)	70	2.1-2.45 (3-3.5)	6-7

**Fresh weight of silage is based on dry matter intake. Does not take into account feeding of concentrates.*

These intakes are only a guide and requirements can be based on measurement of actual intakes. This may vary depending on space allowance (i.e., if bales are fed in a ring feeder, feed space availability may be less than when silage is rolled out or fed through a mixer wagon down the feed pass. Silage intake will also vary depending on processing. For example, chopped silage can greatly increase intakes in ewes compared to unchopped material.

Remember to factor in any carryover stock from the previous year and add a safety factor in case of a longer winter as well as waste (say 5-10%).

Forage Quality and Concentrate Saving

This may depend on the type of livestock the silage is destined for but generally the higher the better. The higher the energy and protein content per kg of dry matter, the lower the requirement for purchasing concentrate feeds such as cereals and protein sources to meet performance targets and balance deficiencies in the forage. Forage quality will affect intake as more mature forages with a higher NDF (neutral detergent fibre) content pass slower through the digestive tract, lowering dry matter intake, as well as requiring more concentrates to meet performance targets.

For dry spring calving suckler cows over the winter good quality silage (10ME+) can either be restricted or diluted down with straw to reduce energy intake and avoid excessive weight gain. However, the higher the silage quality, the lower the concentrate required for milk production post-calving. A calved suckler cow producing 8 litres of milk will require 1.5kg/day less concentrates when fed on an 11ME silage compared to a 10ME silage. A similar saving in concentrates is also seen when feeding 350kg store cattle targeting 1kg growth/day.

For ewes in the run up to lambing, high quality silage can also reduce supplementary feeding in the pre-lambing period and after lambing for milk production. An 11ME silage will result in a saving of about 4.6kg concentrate/ewe over a six-week pre-lambing feeding period compared to a 10ME silage.

The nutritional value of silage will be affected by several factors such as the age and varieties of grasses in the sward, cutting date, soil health status, fertiliser usage and silage management practices (such as wilting time, handling, wrapping and storage of bales).

The main factor affecting silage quality is the maturity of the grass when it is cut, with earlier cutting leading to higher digestibility, protein and energy values. There is a trade-off between quality and quantity and as the grass starts to head, yield increases. Once headed, digestibility (D value) declines by 0.5% per day. Delaying cutting by one week leads to 3.5 percentage units lower D value, equivalent to 0.6MJ/kg DM of metabolisable energy.

Time of Cutting

Ideally grass should be cut in the afternoon when sugar levels are at their highest. A low sugar content is less likely to produce a good fermentation. However, weather conditions should dictate when to cut and how long to wilt for. Under favourable weather conditions, cutting in the morning and achieving a rapid wilt to the target dry matter later that same day, may produce silage with a higher sugar content compared to cutting in the afternoon with a longer wilting time and the grass being picked up 24 hours later. In sunny dry conditions, a 24-hour wilt may be too long, resulting in more sugar being lost. If cutting in the morning, wait until the dew has lifted. Also ensure full nitrogen utilisation based on grass taking up on average 2.5kg/ha/day of N (2 units/day). Ensure free nitrate levels are below 1000mg/kg DM when cutting, as higher levels can lead to a poor fermentation.

Wilting Length

To some extent weather conditions will dictate the length of wilt but the quicker the better to achieve the target dry matter. Aim for a dry matter of between 35-45% for baled silage and a minimum of 200kg of dry matter per bale, which equates to a bale weight of 570kg. Chopping silage before it is baled will increase bale density by 8-12%. This will help eliminate more air from the bale and allow a faster, more efficient fermentation. At over 28% dry matter there should be no effluent production, eliminating dry matter and nutritional losses. Wilting also enables a more efficient fermentation and by achieving the target dry matter the number of bales and plastic usage can all be reduced, helping keep cost to a minimum.

Wilting can be speeded up by tedding the crop, spreading it over a wide area into a thin layer immediately after cutting. This will speed up the rate of water loss which is greatest in the first two hours post-cutting. Using a conditioner on the mower can also increase wilting speed by as much as 20%, by splitting the grass leaf and increasing the surface area for water loss. The thickness of grass on the ground/in the swath will influence the drying rate. A thin layer will dry out much more quickly compared to grass heaped in a narrow swath.

The longer the wilt the greater the nutritional losses, risk of poor weather and likelihood of spoilage when fed out. Aim to wilt no longer than 24 hours but high clover grass may require longer, up to 48 hours.

Additives

Additives come in various forms: bacterial inoculants (mainly based on Lactobacillus bacteria), acids, enzymes and chemical preservatives. Many silage additives are proven to speed up the fermentation resulting in a quicker drop in pH, reduced microbial growth and spoilage at feed out, lower dry matter and nutritional losses and improved animal performance. Different additives may be more suited to low or high dry matter crops.

Wet crops need to achieve a lower pH to prevent growth of undesirable bacteria. They also tend to be lower in sugar and so an acid additive will give a better fermentation under these conditions as they require less sugars for an efficient fermentation.

Table 2. Silage additive guide.

Type of additive	Mode of action	Comment
Bacterial Inoculants (Two types based on bacterial strains)	Homofermentative bacteria – convert sugars into lactic acid only. Heterofermentative bacteria – convert grass sugars into lactic acid and acetic acid.	Improve the rate of fermentation (reduction in pH) and help minimise protein breakdown. Require more sugar for fermentation and improve aerobic stability at feed out. Less effect on fermentation. More suited to high dry matter silages.
Acid (based on propionic or formic acids)	Allows direct acidification of grass so not reliant on sugars or natural occurring bacteria for fermentation.	Inhibits growth of moulds and yeasts and improves aerobic stability at feed out.
Enzymes	Improves digestibility of grass by converting fibre into sugars for lactic acid production by bacteria.	May be useful for more mature crops and those low in sugar.
Chemical preservatives (e.g., potassium sorbate)	Inhibits growth of moulds and yeasts and improves aerobic stability at feed out.	Benefit for high dry matter crops (>35%).

Wrapping and Storage

A minimum of four layers of wrap should be applied. However, six layers is recommended (providing a more effective oxygen barrier) especially if grass is over 30% dry matter, is stemmy and coarse and when wrapping bales in high temperatures (>20˚C). Wrapping should take place within 24 hours after baling and at their storage area. Otherwise, they can be at risk of damage during transportation.

Light coloured wrap reflects more sunlight than black wrap which can lower bale temperature and lead to better preservation of nutrients. It is also less likely to overstretch in hot conditions.

Handling of bales should be kept to a minimum, as oxygen can get into bales every time they are spiked or moved, even before wrapping. Post-wrapping movement of bales should be done in the first eight hours before the fermentation has really started. Use of a squeeze grab can also result in oxygen ingress once the grab is released.

Bales should be stacked on a hard, smooth surface, easily accessible for feeding out and where they can be regularly observed for signs of puncture or bird damage. Prevent damage during storage by covering the stack with fine mesh netting above tyres placed on top of the bales. Any damage should be repaired immediately, or the bale shortly fed out. Store at least 10 metres away from water courses.

Ideally wet bales should not be stacked on top of each other and stored in single rows, although this is not always practical if space is limited. Stack no more than two high on their round side. If stored on their flat end, the stack may collapse (safety issue) and nutrient losses from misshapen and squashed bales can reduce nutritional quality.

Drier bales can be stacked at no more than three high. Mark stacks of bales to correspond to which fields they have come from to help with analysing nutritional quality and allocation of bales to different classes of stock.

If all the bales are to be used on the one site, they can be tubed wrapped instead, saving on plastic. There are also no safety concerns around stacking of bales, especially if they are wet.

Environmental Impact

While silage bales are convenient to use and can be fed without a mixer wagon, they are more expensive to make than clamp silage due to the plastic cost for wrapping the bales. There are many different plastic products available from standard wrap to pre-stretched. They are also available in different colours. Light coloured plastic is thought to be better for its heat reflecting properties compared to black plastic, the latter being more difficult to recycle into other products with a higher cost of disposal. Clear plastic can be more easily recycled into other products after use and so is cheaper to dispose of. Plastic requirements can be reduced with the following actions:

- Forward plan and calculate forage requirements based on livestock numbers and the length of feeding period. Add a safety margin in case of a longer winter but ensure that excess forage is not made, increasing plastic use and potential future wastage. Further information on forage budgeting can be found here: **https://www.fas.scot/downloads/feed-budgeting/**
- Avoid making wet bales, packing more dry matter (and less water) into a bale.
- Consider chopping bales to increase their density, packing more material into a bale.

Summary Top Ten Tips

- Budget the amount of silage required to be made.
- Consider cutting date and the stage of growth of the grass to maximise nutritional quality of silage.
- Soil health should be assessed regularly by soil sampling and testing to correct pH (target minimum pH 6) and address any deficiencies of N, P and K.
- Ideally cut grass in the afternoon when sugar levels are high. However, base cutting decision on weather information and if cutting in the morning, wait until the dew has lifted.
- Wilt the crop as quickly as possible to the target dry matter of 35-45%.
- Wilting can be speeded up by tedding the crop immediately after cutting or using a conditioner on the mower.
- Use an appropriate additive to reduce dry matter and nutritional losses.
- Consider how much plastic wrap is required for effective protection and storage of bales.
- Keep handling of bales to a minimum and stack carefully to minimise damage.
- Try to minimise plastic use as much as possible and recycle responsibly.