



Grassland Management



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Introduction

Well-managed grass provides a cost-effective, high quality feed for sheep and cattle. With farms under increasing pressure to reduce costs and maximise outputs, good grassland management can play a vital role in helping to maximise feed quality and to improve growth rates of your livestock. Good grassland management starts at the soil and its impact is felt right through to the eating quality of the final product by the consumer.

This booklet aims to bring together the latest information and practical advice to help livestock farmers in Wales to achieve good grassland management. It describes the advantages of utilising high-quality forage crops and the benefits of different grazing systems whilst meeting cross compliance requirements and minimising environmental impact.



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Sward establishment and maintenance

The importance of soil analysis

Maintaining viable stocking rates and good animal growth rates relies on maximising output from swards sown for cutting and grazing. In both **short-term swards** (2-3 years) grown for cutting and **longer-term swards** (5+ years) the proportion of the more productive ryegrass species will decline as the plants of **indigenous species** (including agrostis, rough-stalked meadow grass) regenerate. This leads to a decline in both the quality and yield of the sward.

As short-term swards reach the end of their productive life the most practical strategy is to reseed the field. In longer-term leys based on perennial ryegrass you can either **reseed** and establish a new sward or **renovate** the existing sward by overseeding or slot seeding.

ESTABLISHING NEW SWARDS

New swards are usually established on lowland farms in the spring or late summer, whereas July to early August is the most suitable time on many upland farms. Spring sowings provide herbage for grazing later in the same season while late summer sowings allow up to two cuts of silage to be taken from the previous sward. Spring barley is a useful nurse crop for establishing spring-sown swards. Mixtures that include clover should be sown before mid-August.

BEFORE RESEEDING CHECK THE SOIL STATUS:

- **Test the soil** to identify any deficiencies in phosphate (P), potash (K), magnesium (Mg), acidity (pH) and organic matter. Target minimum soil indices are 2 for both P and K. Further testing may be needed if there is a risk of **trace element deficiency**
- Sample grass fields to a depth of 7.5 cm with a corer (15 cm in arable fields). Take 25 samples by walking the field in a 'W' pattern to provide one bulk sample for analysis
- Check the physical condition of the soil and ensure that future production will not be adversely affected by any **soil compaction** (i.e. soil pan) or water logging

SOIL COMPACTION WILL:

- restrict potential **rooting depth** by making crops more prone to **stress** during dry periods and due to bad drainage during periods of heavy rainfall
- reduce **earthworm populations**

FIELD OPERATIONS:

- Ploughing will remove soil compaction caused under less favourable ground conditions by cattle treading or the impact of machinery during silage making. Deeper **subsoiling** may be required for deeper pans
- Sow seed at the **recommended rates** – inadequate seed rates will reduce productivity and encourage open swards that are vulnerable to weed invasion
- Sow seed in the top 15 mm of a fine tilth when the soil is warm and has adequate moisture
- Roll the seedbed to ensure good consolidation
- Encourage plants to **tiller** by lightly grazing with young cattle or sheep when the ley is 7.5 - 10 cm

SEED MIXTURES:

Before purchasing seed mixtures decide on the future utilisation of the sward (longer-term ley for grazing, short-term ley for silage) and the type of stock that will be grazing the swards (sheep, cattle, sheep + cattle). Will fertiliser-N (conventional) or white clover (organic, low input) be the main source of nitrogen?

- swards for cutting should include varieties with similar cutting dates to ensure they can be cut when optimum yield and quality is reached
- swards for grazing should include species and varieties that **maintain productivity** during the grazing season, provide good ground cover and persistency. Many mixtures include both intermediate and late heading perennial ryegrass varieties. Establishing a dense, well-tillered sward will reduce the risk of poaching



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COMMERCIAL MIXTURES AVAILABLE INCLUDE:

- 100% perennial ryegrass for fertilised longer-term swards for grazing/silage
- perennial ryegrass + white clover for organic and low N-input farms
- Italian ryegrass + Hybrid ryegrass for short-term swards for cutting with/without red clover

Some seed mixtures used for establishing longer-term swards also include other species including Timothy (highly palatable), meadow fescue (tolerates wetter conditions), cocksfoot (deep rooting and suited for dry soils), alsike clover (tolerates lower pH and soil fertility than red clover) or herbs such as chicory and plantain (deeper rooting, high mineral content).

MAINTAINING EXISTING SWARDS

MAINTAINING GOOD PRODUCTION DEPENDS ON:

- maintaining soil nutrient status - **test the soil** every:
 - 4-5 years in fields cut for **silage**
 - 7-8 years in **grazed** fields
 - 2-3 years on **sandy soils** or in **high rainfall** areas
- always sample at the same time each year and at least 2 months after the last slurry or fertiliser application
- **good management** of the grazing and cutting swards
- the survival of the most productive species (grass, white clover)

RENOVATING EXISTING SWARDS

A useful way to **improve the composition and yield** of a low yielding sward is to introduce seed of more productive species, including high-yielding ryegrass varieties, or white clover when fertiliser-N inputs are to be reduced.

Renovation can be carried out in both reseeded swards and permanent pastures grown on lowland and upland farms.

RENOVATING A SWARD:

- is **cheaper and faster** than reseeding
- is only beneficial if the poor productivity of the existing sward is due to poor botanical composition or an open sward prone to weed invasion, rather than a management problem that has NOT been addressed including soil nutrient deficiency, soil compaction, over grazing or cutting swards too low during silage making

- **hybrid ryegrasses** and **tetraploid perennial ryegrasses** have larger seeds, tend to germinate faster and are more aggressive than diploid varieties
- is a useful technique on shallow soils or stony ground
- seed establishment rate is less reliable compared with reseeding

**RENOVATING OPTIONS:**

- **over seeding or surface seeding:**

- seed rate of 8-10 kg/acre for ryegrass + white clover mixtures
- seed rate of 1.5-2.0 kg/acre for white clover

- **slot seeding or direct drilling:**

- this ensures good contact between seed and soil
- higher germination rates than oversowing technique
- slugs eating the germinating plants can be a problem during wetter periods

GUIDELINES FOR OVERSOWING:

- only oversow into swards grazed down to a **sward height of 3-4 cm**
- **harrow or rake** the area in two directions until the sward is open and most of the weed grasses and trash in the bottom of the sward has been removed – normally between 2 and 6 passes
- aim to achieve at least **25% bare soil surface**
- spread seed **immediately after harrowing**
- apply P and K fertiliser if required but **NO nitrogen**
- either **use stock to trample** in seed or a flat roller
- continue to graze until seedlings start to emerge, then rest the area for 4-5 weeks
- **sowing time:**
 - spring – plenty of moisture available, but lower soil temperatures can delay germination and increase competition from the established grass plants
 - after a silage cut – swards are open and require less harrowing, less risk of prolonged drier conditions after later silage cuts



Fertiliser use, farm manures and weed control

Maximising output from grassland systems while minimising the environmental impact depends on the **efficient use** of on-farm manures and slurry, the use of legumes to provide nitrogen via fixation and the application of purchased fertilisers. **Minimising** the effect of weed populations in grass systems is also essential to avoid **reducing** the quality of swards grown for grazing and ensiling and, in the case of bracken and ragwort, the risk of toxicity to stock.

NUTRIENTS FOR GRASS CROPS GROWN FOR GRAZING AND SILAGE

Whether grass and grass+clover swards are to be grazed or cut, the availability of adequate nutrients will ensure that **good yields** are achieved. However, applying **excess nutrients** from either fertilisers or on-farm manures increases the risk of **environmental losses**, feed energy-protein imbalance and unnecessary costs.

The **main sources** of nitrogen (N), phosphate (P), potash (K) and calcium (Ca) on grassland farms are from:

- nutrients in the soil, including residual nitrogen from previous clover crops
- **purchased fertiliser** applications that supply straight N, N-P-K, lime, trace elements or sulphur
- farm yard **manure** (FYM) and **slurry** – a valuable source of nutrients that should not be regarded as just a ‘waste product’
- **nitrogen fixation** by clovers and other legumes – the main N-source on organic farms and many conventional farms
- excreta from **grazing stock**

Cutting and ensiling rather than grazing swards increases the **off take** of nutrients. Always apply fertilisers at the **appropriate time** and in **favourable** weather conditions. Maintain soil P & K indices at **2 or above** by applying phosphate and potash from fertilisers and manures when required. Grass + clover swards are more sensitive to P and K shortages than pure grass swards.

NITROGEN FERTILISERS

Nitrogen has a **major role** in the growth and yield of grass swards. However, the efficient utilisation of nitrogen depends on the correct timing of applications, nitrogen inputs from other sources and the future utilisation of the sward.

Factors affecting the application rates and efficient utilisation of **nitrogen fertilisers** include:

- the need for adequate **soil temperatures** in spring when a T°- Sum of 200 (based on the accumulated average temperature from 01 January) should be reached before fertiliser is applied to ensure nitrogen is efficiently utilised when grass growth starts at 6°C (see table 2.1)
- a balanced supply of other nutrients (P, K etc) and satisfactory soil pH
- ensuring that the nitrogen available from **other sources** (soil N, quantity of slurry/manure applied, clover content of the sward) is calculated BEFORE applying nitrogen fertilisers. The quantity of nitrogen available from the soil is influenced by the previous management (see table 2.2)
- **SILAGE** swards: A 2-cut silage system may produce 10 t DM/ha and will remove between 200-400 kg of N/ha. Do NOT apply nitrogen fertiliser to red clover swards
- **GRAZING** swards: Grass swards for grazing with higher stocking rates should receive a **maximum** of 60 kg N/ha in the initial application in spring. Further applications during the grazing season should be lower, reducing during the season to a maximum of 30 or 40 kg N/ha. Grass + white clover swards on non-organic farms should only receive a maximum of 40 kg N/ha applied only in the spring
- **expected yields** from the grass sward - high-yielding short term leys having a higher N-requirement than lower yielding permanent pastures

Table 2.1. A guide to the spring fertiliser application date

Location/altitude (metres)	Early sites <i>Coastal, south aspect, light & well drained soils, short-term sward</i>	Average sites	Late sites Heavier soils, impeded drainage, permanent pastures with low ryegrass content, steep slopes
Lowland (<100)	Early February	Late February	Early/mid March
Upland (100-250)	Early March	Mid March	Late March
Improved hill (>250)	Late March	Early April	Late April

Table 2.2. A guide to the *Soil nitrogen supply (SNS)* from previous cropping and inputs

Soil nitrogen supply (SNS) status	Previous management	Previous nitrogen use (kg/ha) (including fertilisers + available manure/slurry N)
High	Long term grassland	>250
Moderate	Long term grassland that received 100-250 kg N/ha last year OR with substantial clover content. Or a first-year ley following 2 or more years of arable – NOT on light sand soil.	100-250
Low	Long term grassland with low inputs. First-year ley following 2 or more years of arable crops on light sandy soil	<100

Table 2.3. A guide to nitrogen application rates (kg/ha) for swards to be *cut for silage*

Soil nitrogen supply status (SNS):	Low	Moderate	High
Silage quality:			
68-70 D silage (generally 5-6 weeks regrowth before cutting)			
1st cut	150	120	120
2nd cut	110	100	100
3rd cut	80	80	60
64-67 D silage (usually >7 week regrowth before cutting)			
1st cut	150	150	120
2nd cut	120	100	100
3rd cut	100	80	80

MANURE AND SLURRY:

These are valuable sources of **P and K** that can reduce purchased fertiliser inputs. But,

- they can be a **variable** product – cattle slurry ranges from 2-10% DM. Plants can utilise 50-60% of the P and 90% of the K in slurry and manures (see table 2.4)
- **timing** of application is crucial to **minimise environmental losses** and ensure that nutrients are utilised by the grass or grass+clover sward
 - **avoid applying** in late autumn/early winter when high rainfall increases nutrient leaching and runoff and when nutrient uptake is poor due to low soil temperatures
 - **avoid applying** on steep slopes, waterlogged ground or frozen ground
 - avoid **heavy applications** of >35m³/ha (3150 gallons/acre)

Ploughing and **incorporating** manure or slurry into the seedbed will help to reduce potential nutrient losses and help to improve soil structure. It will also avoid problems of slurry/manure impeding the drill and restricting seedling growth.

	DM%	Total nutrients		
		Nitrogen (N)	Phosphate (P ₂ O ₅)	Potash (K ₂ O)
Solid manures			kg/t	
Cattle FYM	25	6.0	3.5	8.0
Poultry manure	30	16.0	13.0	9.0
Slurry			kg/m ³	
	2	1.0	0.6	1.5
	6	2.3	1.2	2.7
	10	3.5	2.0	3.8

Table 2.4. The composition of solid manures and slurry from beef units

WEED CONTROL

The major weeds influencing the production of grass and grass+clover swards are **docks and thistles**. Chickweed is a problem in some newly sown swards and bracken, ragwort or rushes can be a specific problem on some grassland farms. **Herbicide use** is an option for many conventional farmers while organic farms and farms in some agri-environmental schemes rely on good **management** and mechanical **practices** to achieve effective control.

Weed problems can be caused by:

- **poor** soil fertility
- **slow sward** establishment
- **open swards** cut for silage due to erect plants and bare ground
- cutting too **low** during silage making
- **overgrazing**, poaching
- **high slurry applications** and soil compaction during slurry spreading

CREEPING THISTLES

Thistles can spread rapidly by creeping roots, with new shoots produced in spring, They are usually more prolific on sheep farms. Thistles occur in open non competitive swards due to under grazing when thistles are at the growing stage (May-July) or overgrazing in the winter and early spring.

Controlling thistles:

- **maintain** good soil fertility
- when reseeding, **deeper cultivations** damage and weaken plant roots
- graze lightly in winter and spring, **increase** stocking rate in May-July
- **cut swards** for silage at the early stage of thistle growth
- **top grazed swards** twice a year to prevent seeding and to deplete the nutrient supply to the plants
- use **herbicides** on conventional farms

DOCKS

Docks thrive in bare soils and open swards, developing a deep tap root and producing seed that remains dormant for up to 70 years. Docks are particularly prevalent on fields receiving slurry applications prior to the cutting of the swards for silage and on fields grazed only by cattle, rather than mixed cattle and sheep stocking.

To prevent **seeding**:

- cut swards before docks seed, top grazed fields before docks begin to flower

To reduce dock plants **establishing**:

- use a nurse crop (spring barley) to establish spring-sown swards, establish a dense sward bottom by encouraging grass plant tillering, apply the appropriate quantity of slurry evenly, and avoid poaching

To prevent plants **maturing**:

- use sheep to graze newly established swards and remove any rogue weeds by hand


To **kill or weaken** tap roots and seeds:

- compost manure thoroughly to kill seeds, use herbicides on conventional farms, drag roots to the surface for desiccation when reseeding



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Grazing management and livestock performance



Well managed grass provides a cheap, **high quality** feed for livestock. Good grassland management aims to maximise grass quality whilst maintaining sward structure to maximise forage intakes and can lead to faster growth rates in livestock.

GRAZING QUALITY

There are 3 main factors that determine the nutritional quality of grassland:

1. DRY MATTER CONTENT (DM)

- Low forage DM reduces intake by livestock
- Below 12 % DM animals will not be able to consume enough food to meet their energy needs and may need supplementary feed
- A highly variable factor depending on season, grass growth stage and management

2. DIGESTIBILITY (D VALUE) AND ENERGY

- Change throughout the grazing season
- Young, leafy swards are most easily digested and contain more energy than swards starting to head or containing dead material
- Closely linked to animal performance: a decline of 1 D unit = a drop of 5 % in livestock gain

3. PROTEIN

- Protein levels are linked to grass growth stage and are affected by soil nutrition
- Protein content of grass is affected by nitrogen uptake from the soil – so is influenced by nitrogen applications but also by soil potash, sulphur and pH
- High protein levels in forage can negatively affect animal health if sufficient energy is not available to balance the diet

CONTROLLING SWARD QUALITY

One of the best ways to control **sward quality** is to measure **sward heights**. Knowing the amount and the quality of the forage available can allow for a greater use of grazed grass and aid management decisions on:

- Setting the correct stocking rate
- Putting the right stock on the best fields
- Extending the grazing season
- Optimising fertiliser use
- Avoiding restricted grazing before livestock growth rates are affected
- When to give supplementary feed

MEASURING SWARD HEIGHTS

The simplest way to measure sward height is to use a ruler or tape measure with a large scale

- Place the ruler on the ground and take a reading of the top level of the grass leaf – do not measure flowering heads or weeds
- Repeat this approximately 40 times whilst walking in a W pattern across the field. Take care to avoid areas of uneven ground and gateways

Some farmers take measurements as often as twice weekly during the peak growing season. To maintain sward tiller density, graze fields to the recommended 'post-grazing' height in tables 3.1 and 3.2.

Silage aftermath swards will respond differently to grazing pressure and should be encouraged to tiller before applying sward height guidelines.

SSH – SURFACE SWARD HEIGHT

Table 3.1. BEEF CATTLE

Livestock Type	Graze Period	Grazing after rest on un-adapted sward		Continuous cm	Notes
		Pre-graze cm	Post-graze cm		
Suckler Cows	T'out-May	10-14	5-6	5-6	
Lactating	June-July	12-15	7-8	7-8	
	Aug-Nov	12-15	8-9	7-9	Graze to 5cm with dry stock Nov/Dec
Suckler Cows Dry				4	Note condition. Increase to 5-6cm for thin cows; restrict grazing for fat cows
Growing/ Finishing Cattle	T'out-May	10-12	5-6	5-6	Increase by 1-2cm for finishing cattle through season
	June-July	10-14	6-7	6-7	SSH should be gradually increasing
	Aug- Sept	10-15	7-8	7-8	

SSH – Surface Sward Height

Table 3.2. SHEEP

Livestock Type	Grazing Period	Grazing after rest on un-adapted sward		Continuous cm	Notes
		Pre-graze cm	Post-graze cm		
Ewes & lambs	T'out-April	8-10	4-5	4	Feed until 4+, gradual increase if possible
	May-wean	8-10	4-6	4-6	
Dry Ewes	July Aug			3	Reduce to 6cm for Condition Score >3
Pre-tupping	Sept-Nov	8-10	4-5	6-8	
Weaned lamb for finish	July-Sept	10-12	5-7	6-8	Allow gradual increase
Store lambs	July-Start of finishing period	NA		4	



USE OF CLOVERS

- Good source of **high protein** forage
- Increase forage intakes and has a complementary growth curve to grass
- Improves **soil fertility** (fixes nitrogen) and soil structure
- Contain **high mineral content** – may reduce health problems in livestock (e.g. grass staggers / hypomagnesaemia)

Mechanical Approaches

- Swards can be topped tightly (i.e. below target grazing height) to encourage tillering and to improve sward density
- Topping immediately prior to grazing increases forage DM content and intakes by livestock
- Grass harrows can be used to remove invasive grass species (e.g. creeping bent) and dead material

OTHER GOOD GRAZING MANAGEMENT OPTIONS

GRAZING OPTIONS

- **Mixed grazing** with cattle and sheep improves sward quality and utilisation
- Leader-follower systems (older stock follow younger stock) have been shown to improve growth rates in young stock

SWARD COMPOSITION

To maximise **nutritional quality**

- Check that sown species (e.g. ryegrass, timothy, clover) still form the main proportion of the sward – remembering that the D value of ryegrass is superior to invasive grasses (e.g. Yorkshire fog)
- Consider reseeding or over-sowing to maintain sward quality
- Ryegrasses bred with high sugar levels have been shown to improve livestock performance



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Mixed grazing

When compared with the grazing of either cattle or sheep separately, **mixed grazing** with cattle and sheep can:

- improve pasture **utilisation** and maintain **sward quality**
- increase **growth rates** in livestock
- reduce **internal parasite** burdens

IMPROVING GRASS UTILISATION AND QUALITY

Cattle and sheep have different grazing preferences so mixed grazing can:

- Improve sward quality by **reducing rejection areas** around dung patches and increasing the proportion of white clover in the sward
- Increase **grass utilization** (by up to 15%)
- A stocking ratio of 60:40 cattle to sheep or sheep to cattle will give maximum benefits



IMPROVING GROWTH RATES IN LIVESTOCK

- Livestock output per ha may be increased by mixed grazing
- Live-weight gains can be improved in sheep or cattle or both, depending on sward management
- Grazing cattle and ewes with lambs throughout the season can increase the live-weight gain of lambs when sward heights were kept at 8-10 cm (but not when kept at 4-5 cm)

- Mixed grazing throughout the growing season can increase lamb live-weight gain compared with alternate grazing (pastures grazed with cattle early in the season, followed by lambs post-weaning)

REDUCING INTERNAL PARASITES

Always start a **management plan** to reduce internal parasites in your livestock by consulting your veterinary surgeon.

- Generally, sheep and cattle are infected by different parasite species
- Mixed grazing to reduce internal parasites is based on a diluting strategy – e.g. if young lambs graze with cattle - pasture infection levels will be low
- Grazing cattle and sheep reduces internal parasites in lambs compared with grazing with sheep only throughout the season
- Consideration is needed when grazing sheep with young cattle (under 12 months old) as *Nematodirus* can infect both sheep and young calves

HOW TO REDUCE THE PARASITE RISK TO LAMBS FROM DIFFERENT PASTURES

Lambs and lactating ewes are the main sources of pasture contamination with parasite eggs.

- Divide the grazing season into two parts – usually with 30 June as the mid-point for sheep in the UK
- If lambs, lactating ewes, goats or young cattle (under 12 months) grazed the pasture in the previous year - it must be regarded as a high risk pasture until the middle of the season because of the risk of *Nematodirus*
- In the second part of the grazing season, parasites on pastures are from the current year
- If grazed by adult cattle or cut for forage conservation in the first part of the grazing season then the pasture has a lower parasite risk in second part of the season

More information about the benefits of mixed grazing can be found in the HCC booklet on this subject.

Conservation of silage, haylage and hay

SILAGE

Silage making is the efficient conservation and preservation of fresh forage to preserve a high proportion of the nutritional value of the green forage. The **fermentation** process occurs under **anaerobic** (no oxygen) conditions and has a significant influence on the quality of the silage produced. The aim is to ferment the ensiled crop as quickly as possible to maximise the production of lactic acid, achieve a rapid decline in the pH and prevent protein breakdown.

Ensure that your silage making practices meet both the Cross Compliance requirements and the 'Codes of Good Agricultural Practice'.

GRASS AND GRASS+CLOVER SILAGE

Grass silage from fertilised ryegrass-dominant swards is the main forage conserved for feeding during the winter on conventional farms with organic farms relying on **grass+clover** silage or **red clover** silage. Permanent pastures also make an important contribution on many farms. Other crops which are ensiled include **whole-crop cereal** silage and **forage maize**.

Good quality silage is palatable and leads to high intakes, good growth rates and an opportunity to minimise concentrate inputs. However, there are often large variations in silage quality (Table 5.1) both between farms and different clamps on the same farm. Poorly made, low quality silage not only reduces animal performance but also **costs as much** to produce per tonne as good quality silage.

Table 5.1. A guide to types of fermentation

Fermentation	Silage colour	Smell	Texture
Good	Bright. Light green-yellow	Fruity or vinegary	Firm. Soft tissue not easily rubbed from fibres
Satisfactory	Light brown	No strong smell	Fairly firm
Poor (Butyric)	Olive green	Strong offensive	Slimy – soft tissues easily rubbed from fibres
Overheated	Brown to dark brown	Caramel/tobacco	Dry and very friable



KEY POINTS TO AID FIELD OPERATIONS:

- avoid late applications of **slurry** to the fields to minimise the risk of contamination when the field is cut. Apply **fertiliser-N** at least six weeks before the intended cutting date of grass swards. In grass + clover swards grown without a spring application of fertiliser-N the **slower spring growth** of the clover will reduce the protein content of early cut crops
- **leafy crops** are higher quality (see table 5.2) but lower in DM content
- only cut **weed-free** swards
- increasing the **number of silage cuts** per season can increase quality but also reduce the total annual quantity of silage
- when **mowing** grass swards leave at least 5 cm aftermath height to encourage re-growth. When cutting red clover avoid damaging the **crown** of the plants as this will reduce future plant populations and yield
- within one hour after cutting **spread the crop** evenly to aid wilting
- avoid **soil contamination** during spreading for drying & raking
- **wilt** wetter crops – preferably for no more than 24 hours
- ensure **chop length** is 2-2.5 cm
- a good **inoculant** can improve fermentation and animal performance

High losses can occur during the cutting, carting, ensiling and feeding-out of both grass and grass + clover crops (see Table 5.3). With grass + white clover crops, the field losses can be higher due to the loss of the valuable clover leaves if over-wilted crops with a high DM are ensiled.

Table 5.2. A guide to the effect of the stage of grass growth on the energy and protein values

Leaf and stem content	ME (MJ/kg DM)	CP %
Very leafy – no stem visible	12	18
Leafy – some stem present	11	16
Leafy with some flowering stems	10	14
Moderately leafy with large numbers of flowering stems emerging	9	12
Stemmy – grasses near flowering stage	8	10

Table 5.3. Potential losses when silage is made

Stages in the conservation and feeding of silage	potential losses (%)
Field losses during harvesting	2-12
In-silo losses from respiration and fermentation	5-18
Losses in silage effluent	0-8
Feed-out losses due to aerobic deterioration	1-10



KEY POINTS WHEN ENSILING IN A CLAMP:

- **clean out** the clamp before filling
- check the effluent drainage pipes and collection tank are operating correctly and have the appropriate capacity. Silage effluent is potentially a major pollutant
- fill the clamp **rapidly**, spreading the crop evenly and consolidating well
- when the clamp needs to be filled over two days, sheet the clamp at the end of the first day to limit respiration and contact with air
- use side sheets and two sheets of plastic to cover and seal the clamp and ensure that anaerobic conditions (no oxygen) are created in the silo
- **seal** the clamp well and weigh down the sheets to ensure close contact between the ensiled crop and the plastic sheet
- in adverse weather conditions wet and lower sugar crops may benefit from the addition of a **sugar-rich supplement** during the filling of the silo (eg. molassed sugar beet feed)



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KEY POINTS WHEN CONSIDERING BIG BALES:

Big bales may be a suitable alternative to ensiling in a clamp

Advantages:

- low capital outlay and low storage costs
- lower aerobic losses and dry matter losses (10% vs >20%)
- making small quantities allows optimum cutting dates for different crops
- lower pollution risk when high DM bales are made
- surplus bales can be sold or used as a buffer feed in dry summer periods

Disadvantages:

- not suitable for wetter crops
- slower speed of harvest
- risk of variability between bales
- less easy to handle and to mechanically feed on some farms
- more prone to damage during handling and storage

KEY POINTS WHEN MAKING BIG BALES:

- preferably ensile crops at a DM content of 35+%
- use an inoculant to increase fermentation
- wrap bales as soon as possible after baling
- use the recommended number of plastic layers to ensure good fermentation and minimise contamination by *Listeria*
- store bales on a suitable surface at an appropriate distance from watercourses
- remove any mouldy or spoiled silage before feeding to stock

IMPROVING SILAGE UTILISATION:

- analyse silage before opening the clamp/big bales to determine quality
- maintain a **clean clamp face** – if possible use a **shear grab** rather than a fore-end loader, do not disturb silage that is not to be used the same day
- to ensure good silage intakes are achieved avoid **competition** between animals at the silage face (self feeding), ring feeder or trough
- offering stock a **choice of more than one forage** (e.g. grass silage + whole-crop cereal silage) will increase intake

WHOLE-CROP CEREAL SILAGE

Cereal crops (barley, oats, wheat) can be harvested and ensiled 3-4 weeks before the combining stage at a DM content of 35-45% to provide palatable forage for feeding with grass-based silage. Since barley produces hard grains at a slightly earlier stage, this crop should be cut at 35-40% DM.

The crops are cut at a **chop length** of 2 cm when the grains are at the soft-dough/soft 'cheddar' stage. **Energy value ranges from 9-10 MJ/kg DM and the protein content 9-11%**. Wheat and barley crops have a higher energy value than oats.

Advantages of whole-crop cereal silage:

- cereals can be **widely grown** either as a main crop or as a nurse crop for establishing new leys in the spring
- **one harvest** in August/September
- high DM content with **no effluent problems** when ensiled
- increases feed **intake**
- a **lower protein** forage that **complements** high protein, clover silage

Disadvantages of whole-crop cereal silage:

- **in warm weather the harvesting date can be critical** as the DM content of the crop can increase by 2% per day
- **consolidation** in a clamp can be more difficult with high DM crops – ensiling in a 'sandwich' with lower DM grass silage is one option
- unless whole-crop cereals are ensiled in narrow clamps or big bales, the silage may heat up and lead to spoilage
- low protein content unless cereals are either:
 - grown in a **mixture** with peas or vetch
 - fed with clover-based forage
- the silage is attractive to **vermin** particularly when ensiled in big bales

Quality can be improved by:

- growing a **mixture of legumes + cereals**, including peas/barley, vetch/oats
- raising the **cutting height** at harvest to improve the grain to straw ratio when adequate stocks of grass silage have already been made or the energy value of other silages is low
- avoid delaying harvest as the more mature grains may pass **undigested** through the stock



HAYLAGE

Haylage is a high dry matter and palatable feed.

- Haylage is a fermented, **less acidic** forage with a pH of 5.5 or above
- Good quality haylage depends on **fast fermentation** and an inoculant can be applied during baling
- Grass for haylage is cut at a more mature stage (**50-60% DM**) than for silage, but at a more digestible and less mature stage compared with hay crops
- Grass is spread for drying and raked to aid wilting. **Field losses** may be lower when compared with hay crops. Chopping prior to baling will aid fermentation
- Compared with big bale silage, haylage bales can be more **prone to aerobic spoilage** due to their reduced compaction and a higher DM content

HAY

Well made **hay** is a palatable, **non-acidic feed** that can increase the intake of stock grazing low DM herbage or feeding on silage-based diets with both a low pH and DM content.

Delaying the cutting of swards with a high diversity of species to make hay, rather than silage, has **environmental benefits**. Removing stock early during the grazing season allows the plants to grow, flower and set seed before the crop is cut. Refer to your agri environment scheme officer for advice on the role of hay in the management of environmentally sensitive pastures. Further information on agri-environment schemes can be found at the Welsh Assembly Government's website www.wales.gov.uk

The main **disadvantage** of making hay rather than silage making is the dependency on a longer period of good weather to ensure the cut crop is dried to a DM content of >82%. There is also the potential for **higher field losses** and a loss of feed value due to an extended drying period and a need for extra mechanical operations and handling of the crop.



Over wintering and extended grazing

The quantity of silage required for the winter period and both the concentrate and housing costs can be reduced by either growing high-quality forage crops or by extending the grazing season on grass swards. It is important to ensure that implementing either system on the farm will not breach cross compliance requirements and is compatible in relation to soil type, type of stock to be grazed and also any extra requirements for labour and other resources.

OVER WINTERING WITH GRAZED FORAGE CROPS

Forage crops are palatable feeds, producing either high energy (root crops), high protein (forage rape) or both high energy and protein feed (kale).

Forage crops can be grown to provide extra forage for:

- cattle fed silage-based diets
- sheep grazing grass swards

A range of forage crops – kale, rape, stubble turnips, winter hardy turnips and swedes – can be grown on many livestock farms in Wales. Crops which are to be grazed in mid and late winter need to be winter hardy.

Forage crops can be sown from late April to October for grazing from September to March. Earlier sowings lead to higher yields of both leafy and root crops.

Kale with a utilised yield of 6.0 t DM/ha will provide 50 days grazing for either 20 cows or 28 steers. Swedes with an estimated utilised yield of 5.5 t DM/ha will provide 50 days grazing for 90 lambs.



When evaluating the environmental impact of growing and grazing forage crops

- check that the chosen crop is suited to any environmental scheme the farm is participating in
- select a field with lighter soils that has good drainage
- provide a grass area adjacent to the forage crop for stock to use for lying and grazing
- avoid over stocking
- prior to the start of the grazing period and to minimise the risk of soil compaction move the big bales of silage, straw or hay required for feeding to an area adjacent to the grazing area
- consider using grass strips as tramways and buffer areas in the fields when forage are to be grazed in the autumn/winter period
- select a suitable site for feeding silage or other forages in a ring feeder/feed trailer. Move feeders regularly to avoid poaching. Minimise vehicle access to the field

Direct drilling into herbicide desiccated grass avoids soil disturbance and provides a firmer surface for grazing but is not a suitable practice for organic farms or those participating in some environmental schemes.

Analyse the soil to determine the P & K status and check the recommended requirements for the type of crop being grown. N requirements also vary between crops and are influenced by the quantity of soil nitrogen from the preceding crop, particularly legume crops. Check the soil has an adequate pH of >5.6 to ensure good crop growth and also to reduce the risk of club root developing in brassica crops.

GRAZING MANAGEMENT

- strip grazing and the use of a back fence will improve the utilisation of the crop, avoid wastage and minimise poaching
- to avoid digestive upsets introduce animals to the crop gradually over a 10-day period. Allow stock to 'fill-up' on other feeds (e.g. silage) before the initial grazing of the forage crops
- limit the intake of the forage crop to <50% of the total diet to avoid the potential risk of health problems
- provide a consistent quantity of fresh forage each day to avoid fluctuations in the composition of the total diet
- maintain an appropriate stocking density based on estimated intakes of the grazed forage, silage and other feeds
- both the leafy and root forage crops are low in dry matter content and fibre



- well made big bale grass or whole-crop cereal silage both provide a **palatable and drier feed** and also essential fibre. Hay and good-quality straw will enhance the dry matter and fibre contents of the diet
- check the nutritive value of the fresh and conserved forages and provide a **mineral supplement** that is appropriate for the type of stock being grazed. The protein content of kale will vary from 12 to 22% depending on the stage of growth and leaf to stem ratio and the metabolisable energy from 11 to 13 MJ/kg of dry matter. Other forages may be short of energy or protein
- wet and windy weather may reduce intake, whilst cold and windy weather lead to a higher chill factor and increases the animal's feed energy requirements. **Extra feed** may be required during these periods
- check that stock maintain the appropriate **body condition** during the grazing period

Animal health – out wintering rather than housing stock helps prevent pneumonia but may increase the risk of internal worms and liver fluke. Checking the condition of feet prior to the start of grazing the forage crops and maintaining an appropriate stocking density will minimise the risk of lameness problems. Discuss any potential problems with your veterinary surgeon.

EXTENDED GRAZING

Extending the grazing season by deferring the grazing of grass or grass/white clover swards until the late autumn provides an opportunity to reduce feed costs (including the cost of silage production).

Extended grazing is now widely used in dairy systems with the cows grazing for 2-3 hours/day. This system may also be cost effective on some beef farms that have a suitable layout, including access to the grazing area and adequate labour to turn housed cattle out to graze and to manage the movement of the electric fences each day.

The system depends on building up a reserve of grass in the late summer and early autumn period by shutting off paddocks or fields in late August/early September rather than taking an additional silage cut. The **length of the grazing period** is influenced by:

- the quantity of grass available
- ground and weather conditions

Electric fences are used to strip graze the sward and also to provide a back fence to prevent access by the cattle to previously grazed areas.

The potential risk of **poaching** should be considered when an extended grazing system is implemented. In addition to the environmental impact, the yield from over grazed or poached areas will be sharply reduced in the following grazing season, leading to extra costs since surface or reseeding may be needed to ensure that adequate grass yields are achieved. To avoid these problems:

- use swards grown on lighter **well-drained soils**
- choose swards with a **dense base**, avoid open swards
- maintain an appropriate **stocking density** to avoid over grazing
- **avoid** grazing during periods of heavy rainfall and adverse ground conditions

In addition to extending the grazing season in the autumn an earlier turn-out date in the spring can be achieved in some areas and in south-facing fields by reseeding with **early grasses**, including hybrid and early-maturing perennial ryegrass. An alternative method is to direct drill these grasses into an existing sward during the autumn. Forage rye, established by reseeding or direct drilling is another option.

Further information about the use of forage crops and extended grazing systems can be found in the Farming Connect Winter Management Options factsheets which are available from HCC.

Alternative forages

Forages other than grass can also be used to improve intakes and growth rates in livestock and to reduce reliance on supplementary feeding with concentrates. They can also provide forage when grass growth peaks are declining.

CHICORY

Chicory is a broad-leafed forage crop (lasts 2-6 years) with a thick deep tap-root.

- Improves **lamb growth rates** – expect rates above 250 g per day
- Increases intakes without causing bloat
- **High yielding** with good nutritional quality (crude protein 25 % & ME of 10.4) but low dry matter content (approx. 8 - 12 %)
- **Drought-tolerant** – reduces risks of forage shortages during a dry summer
- Is a useful source of home-grown forage for finishing lambs as grass growth rates decline in late summer–autumn
- Contains more minerals and trace elements than grass
- Has **anthelmintic properties** – reduces internal parasites in lambs

VARIETIES AND ESTABLISHMENT

Always choose a recognised perennial variety of chicory

- Sow between May and June – after the risk of frost, which will kill the crop during early emergence
- Recommended sowing rates are 2 kg/acre if sown alone or 0.5 kg/acre if sown in mixtures with ryegrass / clover
- Using a higher sowing rate for pastures under organic management will help weed control
- Tolerant of a wide range of soil pH but prefers 5.6 – 6.0. Soil P & K index 2
- Seed should be shallow drilled at 1 cm or broadcast as deeper drilling (greater than 1 cm) will result in poor establishment
- Use 45 kg / ha of nitrogen at start of spring and additional applications post-grazing. Responds well to nitrogen

Chicory can usually be grazed from about 8 weeks after sowing – the optimum height for grazing is 25-30cm

- Ideally graze rotationally with a minimum rest period of 3 weeks or strip graze using a back fence. This optimises leaf production (whilst reducing the risk of plants bolting) and avoids it being selectively grazed out if sown in combination with grass/clover
- One acre of well-managed chicory will carry 20 lambs for 30-40 days
- Care is needed not to damage the crown of the plant – avoid heavy grazing late autumn and use only light grazing or, preferably, leave ungrazed over the winter
- Don't allow the plants to grow above 30 cm as forage quality declines and intakes are reduced - graze down to 5cm between rotations and top if necessary



GRAZING

RED CLOVER

This forage crop is best suited for **silage** but also provides **high quality grazing** for finishing lambs or beef cattle. It is a medium-term crop with a persistency of 2-3 years. Red clover:

- Is a **high yielding** and **high protein** forage –reducing need for concentrate feeds to supplement silage feeding over-winter
- Fixes nitrogen – reducing reliance on N fertilisers
- Improves soil structure
- May be undersown with spring barley

VARIETIES AND ESTABLISHMENT

Choose a variety of red clover that is recognised as being suited to your farm situation

Sowing rates:

- approx. 5-6 kg/acre for pure sward
- mixed sward: 3 kg/acre red clover +9 kg/acre Italian or hybrid ryegrass.
- Undersown with barley: 3kg/acre red clover + 8kg/acre ryegrass
- Soil pH 6.0 - 6.5, P and K index 2+
- Don't grow continuously in the same field – allow a 6 year break

USING RED CLOVER

Silage

Over 3 years a mixed grass/red clover sward can produce 9-15 t DM/year and the typical silage quality is: 14 -19% CP, ME of 10-11, ammonia-N < 5 %.

- Can take 3 - 4 cuts each year although the number of cuts will affect both the quantity and quality of the crop
- Allow 6-8 weeks between silage cuts
- Ensilage at 25 - 35% DM to avoid losses during wilting (24-36 h wilt)
- Excess conditioning leads to leaf shatter and lower feed quality
- Use a silage inoculant to ensure a rapid fermentation



Grazing

When two cuts of red clover silage are taken, the re-growth can provide quality grazing for finishing of lambs or beef cattle. However:

- It may cause bloat – take care that livestock are not hungry when turned out to pasture
- It can cause infertility - don't allow breeding ewes to graze red clover 6 weeks before and post-tupping
- Do not graze with sheep over-winter - reduces persistency

Grassland and product quality

Improving the **quality** of animal products is important to meet the rapidly changing requirements of consumers who require food which is safe, healthy, traceable, of consistent eating quality, diverse and convenient. It is also important as a route for achieving **product differentiation**, improving **competitiveness** and **adding-value**.

Recent studies conducted at Aberystwyth University have examined ways of improving the nutritional value of meat. These studies have focused on fat and in particular opportunities for increasing the content of fats such as the **omega-3 fatty acids**, because they are known to be **beneficial** to human health. Important **omega-3 fatty acids** include alpha linolenic acid (C18:3n-3), eicosapentaenoic acid (EPA), docosapentaenoic acid (DPA) and docosahexaenoic acid (DHA).

Grass (fresh and conserved as silage) is very high in linolenic acid. Other major fatty acids include linoleic acid (C18:2n-6) and palmitic acid (C16:0). When compared to feeding animals on high concentrate diets, grass feeding results in higher concentrations of the omega-3 fatty acids in the meat. Feeding grass for longer periods results in higher levels of omega-3 fatty acids in the meat.

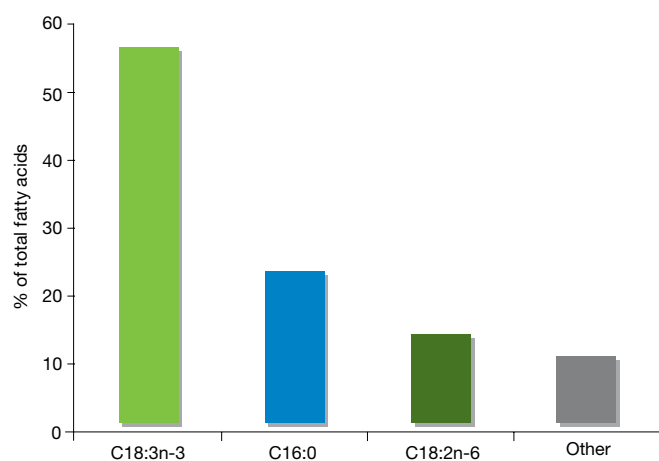


Figure 8.1 Fatty acid composition of grass

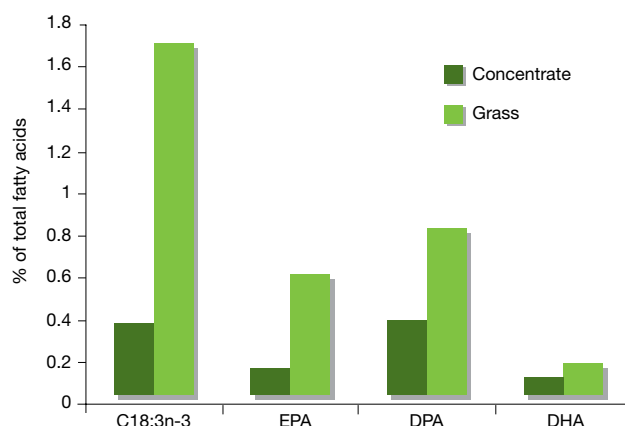


Figure 8.2 The effect of concentrate fed compared to grass fed on fatty acids in beef

Colour and **shelf-life** of the meat are important aspects of the quality for the consumer. Diet not only affects fat composition but also has an important influence on colour and shelf-life. Grass feeding, in comparison to concentrate feeding, enhances not only the polyunsaturated fat content in the meat, but reduces the oxidative changes that occur during retail display, slowing colour deterioration. This is related to the delivery of beneficial **vitamin E** from the grass diet through to the meat. Grass fed beef has been shown to have up to 4.5 days extra shelf life compared to traditional high-concentrate diet beef. There is also some evidence, in particular for lamb, that the taste of the meat is different with grass and more preferred by consumers used to eating **grass-fed** lamb.

To achieve maximum benefit in terms of omega-3 fatty acids and good colour shelf life from grass feeding it is important to maintain **leafy** grass swards. Conserving grass as silage will retain some of these benefits of fresh grass. Wilting is a crucial factor in this: if the grass is over-wilted, for example, 48 hours, it is overexposed to sunlight and will lose the beneficial fats and vitamin E through oxidation. A short, rapid wilt of 5-6 hours, followed by quick ensiling and good clamp management will help to preserve good fatty acids and vitamin E.