Grassland Management

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
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 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

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
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 slurries, 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 Tº- 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 6ºC (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

<table>
<thead>
<tr>
<th>Location/altitude (metres)</th>
<th>Early sites</th>
<th>Average sites</th>
<th>Late sites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lowland (&lt;100)</td>
<td>Early February</td>
<td>Late February</td>
<td>Early/mid March</td>
</tr>
<tr>
<td>Upland (100-250)</td>
<td>Early March</td>
<td>Mid March</td>
<td>Late March</td>
</tr>
<tr>
<td>Improved hill (&gt;250)</td>
<td>Late March</td>
<td>Early April</td>
<td>Late April</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Soil nitrogen supply (SNS) status</th>
<th>Previous management</th>
<th>Previous nitrogen use (kg/ha) (including fertilisers + available manure/slurry N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Long term grassland</td>
<td>&gt;250</td>
</tr>
<tr>
<td>Moderate</td>
<td>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.</td>
<td>100-250</td>
</tr>
<tr>
<td>Low</td>
<td>Long term grassland with low inputs.</td>
<td>&lt;100</td>
</tr>
<tr>
<td></td>
<td>First-year ley following 2 or more years of arable crops on light sandy soil</td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Soil nitrogen supply status (SNS):</th>
<th>Low</th>
<th>Moderate</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silage quality:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>68-70 D silage (generally 5-6 weeks regrowth before cutting)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st cut</td>
<td>150</td>
<td>120</td>
<td>120</td>
</tr>
<tr>
<td>2nd cut</td>
<td>110</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>3rd cut</td>
<td>80</td>
<td>80</td>
<td>60</td>
</tr>
<tr>
<td>64-67 D silage (usually &gt;7 week regrowth before cutting)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st cut</td>
<td>150</td>
<td>150</td>
<td>120</td>
</tr>
<tr>
<td>2nd cut</td>
<td>120</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>3rd cut</td>
<td>100</td>
<td>80</td>
<td>80</td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>Solid manures</th>
<th>DM%</th>
<th>Total nutrients</th>
<th>Nitrogen Phosphate Potash</th>
<th>(N)</th>
<th>(P₂O₅)</th>
<th>(K₂O)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cattle FYM</td>
<td>25</td>
<td>6.0</td>
<td>3.5</td>
<td>8.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poultry manure</td>
<td>30</td>
<td>16.0</td>
<td>13.0</td>
<td>9.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Slurry</th>
<th>(kg/m³)</th>
<th>(kg/t)</th>
<th>(kg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>1.0</td>
<td></td>
<td>1.5</td>
</tr>
<tr>
<td>6</td>
<td>2.3</td>
<td>0.6</td>
<td>2.7</td>
</tr>
<tr>
<td>10</td>
<td>3.5</td>
<td>2.0</td>
<td>3.8</td>
</tr>
</tbody>
</table>

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
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

<table>
<thead>
<tr>
<th>Livestock Type</th>
<th>Graze Period</th>
<th>Grazing after rest on un-adapted sward</th>
<th>Continuous</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Pre-graze cm</td>
<td>Post-graze cm</td>
<td>cm</td>
</tr>
<tr>
<td>Suckler Cows</td>
<td>T’out-May</td>
<td>10-14</td>
<td>5-6</td>
<td>5-6</td>
</tr>
<tr>
<td>Lactating</td>
<td>June-July</td>
<td>12-15</td>
<td>7-8</td>
<td>7-8</td>
</tr>
<tr>
<td></td>
<td>Aug-Nov</td>
<td>12-15</td>
<td>8-9</td>
<td>7-9</td>
</tr>
<tr>
<td>Suckler Cows</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry</td>
<td></td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Growing/Finishing Cattle</td>
<td>T’out-May</td>
<td>10-12</td>
<td>5-6</td>
<td>5-6</td>
</tr>
<tr>
<td></td>
<td>June-July</td>
<td>10-14</td>
<td>6-7</td>
<td>6-7</td>
</tr>
<tr>
<td></td>
<td>Aug- Sept</td>
<td>10-15</td>
<td>7-8</td>
<td>7-8</td>
</tr>
</tbody>
</table>

SSH – Surface Sward Height

### Table 3.2. SHEEP

<table>
<thead>
<tr>
<th>Livestock Type</th>
<th>Grazing Period</th>
<th>Grazing after rest on un-adapted sward</th>
<th>Continuous</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Pre-graze cm</td>
<td>Post-graze cm</td>
<td>cm</td>
</tr>
<tr>
<td>Ewes &amp; lambs</td>
<td>T’out-April</td>
<td>8-10</td>
<td>4-5</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>May-wean</td>
<td>8-10</td>
<td>4-6</td>
<td>4-6</td>
</tr>
<tr>
<td>Dry Ewes</td>
<td>July-Aug</td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Pre-tipping</td>
<td>Sept-Nov</td>
<td>8-10</td>
<td>4-5</td>
<td>6-8</td>
</tr>
<tr>
<td>Weaned lamb for finish</td>
<td>July-Sept</td>
<td>10-12</td>
<td>5-7</td>
<td>6-8</td>
</tr>
<tr>
<td>Store lambs</td>
<td>July-Start of finishing period</td>
<td>NA</td>
<td></td>
<td>4</td>
</tr>
</tbody>
</table>
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
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

**REDDUCING 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’.

Table 5.1. A guide to types of fermentation

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

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.
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

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

Table 5.3. Potential losses when silage is made

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

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 overstocking
- 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
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.
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-leaved 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
GRASSLAND MANAGEMENT

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: 3 kg/acre red clover + 8 kg/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
- ensile 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
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.