Aber®

Clover Management Guide

Increased grazing and cutting potential from cattle and sheep leys

BRITISH SEED HOUSES®

Sefydliad y Gwyddorau Biolegol, Amgylcheddol a Gwledig
IBERS ABERYSTWYTH
Institute of Biological, Environmental and Rural Sciences

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- Enhance summer grazing productivity
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- Fertility building

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Clovers in Sustainable UK Agriculture

Agricultural sustainability is moving from a niche subject to a mainstream concern as more attention falls on the requirement to feed a growing population with diminishing natural resources. For livestock farmers, the emphasis is not only on increasing reliance on home-grown forage, but by doing so whilst using resources more efficiently and with minimal environmental impact. Clovers – both red and white – have a pivotal role to play, and this role becomes more significant each year due to improvements in their capabilities, and recognition of wider attributes such as in building soil structure and fertility.

Greater yields, quality and persistency

New varieties of white clover bred at IBERS are now achieving optimum targets of 30-35% contribution to total sward dry matter under a range of grazing and conservation management systems. This is due to plant breeding that has focused on stress tolerance, grazing tolerance and pest and disease resistance for example, and includes the key dimension of compatibility with modern Aber ryegrass varieties. For the future, the emphasis is on building on this strong platform and developing new varieties that will perform better under drought stress, for example, and be beneficial when farming under restrictions such as NVZs.

Progress is also being made with red clovers, with breakthroughs including greater longevity within swards, with yields of the latest varieties being sustained into a fourth year and beyond. Enhanced grazing tolerance and greater resistance to pests and diseases are also key breeding objectives, alongside the challenge of increasing phosphorus use efficiency to help reduce the need for this diminishing nutrient and minimise environmental pollution. Progress is also being made in increasing polyphenol oxidase (PPO) in red clover, an attribute that has the potential to reduce protein degradation and the resulting nitrogenous pollution.

Testing in the field

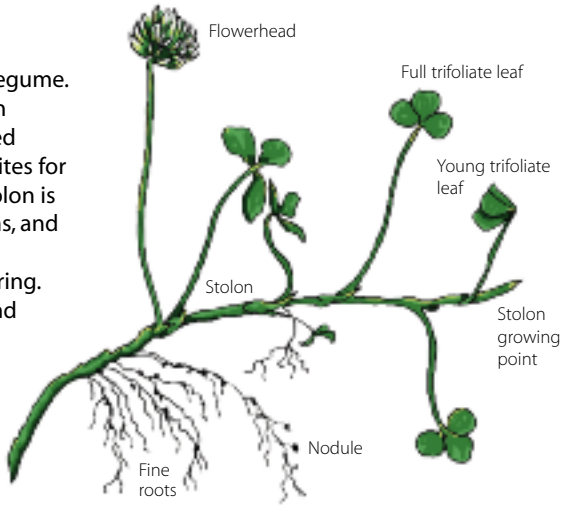
A strong feature of IBERS' grass and clover breeding programme is its affinity with real agricultural practice, which means selection and testing takes into account performance in the silo and in the rumen, as well as in the field under grazing and/or cutting regimes, and even following the application of animal manures.

Dr Athole Marshall
Group leader, Public Good Plant Breeding, IBERS Aberystwyth University

Understanding White Clover

The Plant

White clover is a perennial herbage legume. The key to its survival and production potential is the stolon (multi-branched creeping stem), as this provides the sites for new leaves, roots and flowers. The stolon is a store for carbohydrates and proteins, and provides the ability for the plant to over-winter and regenerate in the spring. Varieties of clover vary in their leaf and stolon characteristics, and it is these often quite marked differences that help to determine agronomic performance.



Usage

White clover is nearly always grown with a companion grass, and most typically with ryegrass, with the type of ryegrass being dependent upon the primary use of the sward.

Developments in white clover breeding have increased the versatility of its use and the longevity of white clover within swards, with greater nitrogen tolerance being a key feature in more intensive systems. Sustainable systems incorporating white clover range from long term leys for continuous sheep grazing (using small leaf white clover varieties) through to medium term leys for rotational sheep or cattle grazing (modern medium leaf varieties), and short term cutting and cattle grazing leys (large leaf varieties).

Key Benefits of White Clover

Nitrogen Fixation – Rhizobium bacteria, which exist symbiotically within protuberances or 'nodules' on clover roots, convert nitrogen from the air into a form that can be utilised by the plant; this process is called nitrogen fixation. This nitrogen becomes available for companion grasses and/or subsequent crops as it is released following plant decay or from the dung and urine of grazing livestock.

It is estimated that the utilisable nitrogen generated through the fixation process is equivalent to 100 – 150 kgN/ha in a well-balanced and stable grass and clover sward.

Intake – Ruminant livestock may consume 20 – 30% more white clover than grass, assuming equal access.

Aber Clover Management

Feed Value – Response per unit of feed intake is greater for white clover than it is for grass. This higher nutritive value is due to a lower proportion of structural fibre, higher protein content, and more of certain key minerals than grass (see table below).

Typical quality characteristics of white clover and perennial ryegrass

	White clover	Perennial ryegrass
Digestibility (D-value %)	75 - 82	65-75
Crude protein (%)	27	17
Dry matter intake by sheep (kg/day)	1.9	1.4
Calcium content (%)	1.6	0.6
Magnesium content (%)	0.18	0.16
Phosphorus (%)	0.6	0.3
Copper (parts per million)	10.0	6.5
Selenium (parts per 100 million)	0.6	0.2

White clover has the added advantage of retaining high digestibility throughout the season, as there is continual renewal of leaves and petioles and relatively little stem development.

Soil Structure – White clover root systems improve soil structure and can help to overcome problems of soil compaction.

Studies at IBERS have demonstrated improved soil structure resulting from a greater white clover component in the sward:

- White clover has been shown to significantly decrease the bulk density of soils and increase porosity.
- Fertiliser recovery from soils with improved structure due to white clover was shown to increase from less than 50% to over 75%.
- General movement of nutrients was improved, with the result that more grass was produced.

Improved soil structure is seen in the soil core with a higher clover content (right)

Aber Clover Management

The Grass-Clover Balance

The proportion of clover in a grass/clover sward is commonly over-estimated, typically by twofold. The images below should be used as a guide to achieving the optimum balance as described later.

If clover does become dominant (i.e. when very little grass is visible), then it can out-compete the grass component and unbalance the sward. This may lead to increased weed ingression and greater vulnerability of the clover to winter damage. This is most common in the second and third years of a ley, and a more desirable grass/clover balance will be seen in the third year and beyond.

If clover dominance is a problem:

- Avoid regular silage cutting sequences, as the regular removal of nitrogen will encourage more clover;
- Consider using smaller leaved clover varieties in future;
- More intensive grazing, particularly by sheep, will suppress the clover;
- Tactical application of nitrogen to enhance grass growth.

15% sward clover content

25-30% sward clover content

50% sward clover content

Sward Composition

Maintaining an optimum dry matter balance of 30% white clover to 70% grass as an average across the season is the key to grass/clover sward management, as this is expected to provide best exploitation of the clover's nutritional and nitrogen fixing attributes alongside high yielding grass.

In the past, white clover growth patterns and the nature of the interaction with grass have tended to cause significant seasonal variation of clover content in swards – from as little as 5% in the spring up to 60% in summer – but clover breeding work at IBERS is producing varieties that are more compatible with modern ryegrasses and have more even seasonal growth curves.

Bloat Awareness

Bloat is the excessive build up of gas (carbon dioxide and methane) in the rumen resulting in distress and possible death due to the exertion of pressure on the animal's diaphragm, heart and lungs. Some legumes, including white clover, present an increased risk of bloat (due to the rapid breakdown of protein in the rumen) if the correct management is not applied.

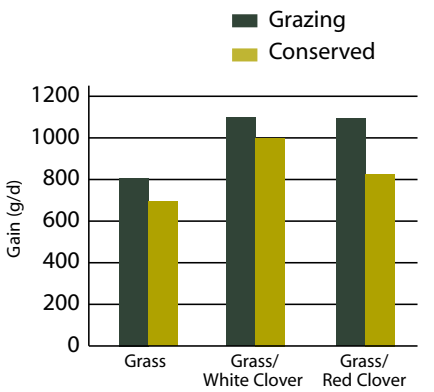
Effective management procedures to minimise or eliminate the risks of bloat in livestock grazing clover-dense swards should include:

- Limiting access to swards when stock are first introduced;
- Avoiding turnout of hungry stock;
- Feeding high dry matter forage such as hay/straw prior to turnout;
- Offering hay/straw at intervals (e.g. to dairy cows at milking times);
- Feeding an anti-bloat feed additive.

Forging an Effective Combination

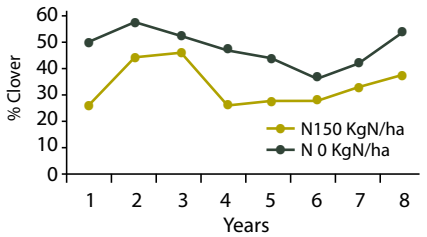
The benefits of combining grass and clover in swards for both grazing and conservation are long established and well proven.

Liveweight Gains on Clover (Beef Cattle)



Source: IBERS

Evidence of persistence of modern white clover varieties (AberDai)



Source: IBERS

The most important benefits can be summarised as:

- Improved forage quality and feed value due to a boost in digestibility, intake potential, and protein and mineral content of the sward;
- Reduced reliance on fertiliser due to nitrogen fixation;
- 'Soil structuring' by white clover root systems that can help to overcome problems of soil compaction.

Aber Clover Management

Accumulated experience and scientific evidence indicate that the optimum balance is achieved with a clover content of 30 – 35% of the total annual dry matter yield of the sward.

In reality, the clover content of a mixed sward will vary from a low level in the spring (as low as 5% of total dry matter) to as high as 60% in July/August. This level of variability in the clover content is not ideal from the perspective of managing the feeding value for livestock and can also cause deterioration in sward quality over time. Hence, greater compatibility between grass and white clover varieties is vital in order for livestock farmers to gain maximum benefit.

Breeding for Compatibility

A compatible grass/clover mixture is one with a clover content that is sufficiently large to optimise the nutritional and nitrogen fixing attributes of the clover when growing with a high yielding companion grass.

Grass and clover varieties differ in their aggressiveness towards each other due to their abilities to compete for nutrients, water and light. At IBERS, breeding for general compatibility is high on the agenda and varieties are routinely tested for this attribute.

Evidence of the progress that takes clover into a new era of utilisation is summarised by three key areas:

- Annual clover contributions of 30% or greater from IBERS-bred varieties have been proven experimentally and are now being seen on the farm.
- Compatibility with modern Aber High Sugar Grass varieties (perennial and hybrid ryegrasses).
- Evidence from long-term experiments showing effective levels of clover being maintained in swards for many years under high and low N regimes.

Trials at IBERS Aberystwyth University have involved selection under grazing pressure and for compatibility with Aber perennial ryegrass and hybrid varieties

Managing White Clover

Successful Establishment

Targets
The aim at establishment should be to achieve a minimum of 150 clover seedlings per square metre within a mixed white clover/grass sward.

Techniques
In a rotational situation, preceding crops should ideally be cereals, roots or brassicas, which lead to reduced nitrogen levels in the soil and encourage clover establishment. Broadcasting is the most reliable method of establishing a clover-based sward, and is generally considered more successful than drilling.

Undersowing to a cereal crop is an alternative, particularly if the cereal is to be harvested early (July) for wholecrop. If undersowing grain crops, cereal varieties should be early maturing and lodging resistant, and cereal seed rate should not exceed 140kg/ha (56kg/acre). White clover can be introduced into an existing sward (see page 11).

Timing
April – mid-August is the optimum sowing period on most UK farms. Seedlings must have begun producing stolons before the onset of winter.

Seedbed
A clean seedbed is essential, and this should ideally be ring rolled prior to sowing. Optimum soil pH is 6.0 – 6.5. Liming to correct pH should be carried out well in advance of sowing. Fertiliser nitrogen should only be applied in low N status soils, up to 50kgN/ha. Phosphate (P_2O_5) and potash (K_2O) is required at application rates of 50 – 120 kg/ha, depending on soil indices.

Seed Rate and Sowing Depth
Seeds mixtures should contain between 2 and 4kg/ha (0.75 – 1.5 kg/acre) of white clover seed depending upon environmental conditions to achieve target establishment and an optimum balance in the sward. Optimum seed depth is 5 – 10mm.

Slugs

Stem eelworm damage

Sitona weevil

Leatherjackets

Combating Pests and Diseases

The main pests affecting white clover during establishment are:

- **Slugs**; potentially devastating in problem areas.
- **Stem eelworm**; causes distortion of growing buds and young leaves and death of the plant.
- **Sitona weevil**; more common close to arable areas and leads to the removal of small semi-circular sections of leaflets.
- **Leatherjackets**; more common following the ploughing of old pastures.

The most common disease affecting white clover is **clover rot** (Sclerotinia), which causes a generalised rot of the plant (see page 20).

It is important to be aware of the risks of both pests and diseases and take the appropriate action, including selection of new stem nematode resistant Aber varieties (where available) and use of agrochemicals following advice from a qualified agronomist.

In the case of damage from pests and disease, the mobility of white clover resulting from stolon extension allows rapid re-colonisation by surviving (and possibly resistant) plants, thereby reducing the impact of infestation.

Weed Control

First and foremost, a clean seedbed is essential in order to avoid competition from weed species during establishment.

Most annual and some perennial weeds can be controlled by regular pasture topping, but it may be necessary to use herbicides in some circumstances, in which case ensure a clover-safe product is used and only spray if clover plants are vigorous and well developed.

Establishment options

Introducing White Clover into an Existing Sward

White clover can be introduced to an existing sward through a variety of methods, from slot seeding to broadcasting following scarification. Greatest success will be achieved by observing the following principles:

- Minimise competition from existing plants prior to sowing by heavy grazing and/or harrowing to open up the sward.
- Observe normal sowing timings (April – August) and soil nutrient/pH status parameters.
- Take advantage of the period when grass is least vigorous (after flowering in July) if there is sufficient soil moisture, particularly after a silage cut.
- Ensure soil is sufficiently disturbed to allow seed contact and coverage (5 – 10mm seed depth).
- Use a higher seed rate (4kg/ha or 1.6kg/acre) than conventional sowing to compensate for greater seedling loss. Lower seed rates (from 2.5 kg/ha or 1kg/acre) may be used for a periodic top-up in long term swards.
- Use slug pellets as an established sward may well harbour this pest.
- Graze lightly and in short periods until clover is well established.

Two Stage Establishment

Effective control of annual and perennial weeds in new sown leys has become more difficult due to the withdrawal of some products in recent years.

Particular difficulties occur in relation to clover, so new approaches are required to ensure the establishment of weed free grass and clover swards.

One such method is to establish a weed free grass ley in advance of introducing clover, using a two-stage system.

Two Stage Establishment (continued)

Following an existing ley with perennial weed problems (docks, thistles etc.):

1. For autumn reseeds start the control of perennial weeds in the preceding spring, using a systemic agrochemical that targets the important weeds.
   For spring reseeds start weed control in the previous season.
2. Use glyphosate (3 – 6 litres/ha) to 'kill off' old ley and any surviving weeds.
3. Sow new ley mix (excluding clover).
4. Monitor ley during establishment. Treat weed problems if necessary from three true leaves of the grass onwards. Non clover safe options give broader more effective weed control.
5. Stitch clover into established sward (April – August) at least 6 weeks after weed control (as above).

Following arable crops/maize or weed free swards:

1. Use glyphosate at 1.5 – 4.0 litres/ha (arable stubbles) or 3-6 litres/ha (grass swards) to 'kill off' old ley and any weeds.
2. Repeat steps 3 – 5 as above.

Check agrochemical application rates with your BASIS qualified supplier

Systems in practice

Grazing Management of White Clover

- Observe size and vigour of stolons in the spring in order to determine optimum management strategy.
- Ensure the appropriate variety is grown for intensive grazing.
- Avoid excessive stolon damage through poaching.
- Use intensive grazing, particularly by sheep, as a brake on clover content, or less frequent cutting to increase clover content.
- Keep grass at 4 – 6 cm over winter to protect stolons from frost damage.
- Choose suitable companion grasses and the best clover varieties of appropriate leaf size for the system.

Continuous Grazing

- Use smaller leaved varieties to withstand hard grazing pressure.
- Modern varieties grown with compatible companion grasses in long term leys can sustain high dry matter yields for the duration of the ley, assuming low nitrogen fertiliser inputs.

Rotational Sheep Grazing

- Modern medium leaf varieties are most suitable.
- Consider inclusion of small leaf varieties where grazing pressure is heavy.
- Swards with 30% white clover content can be maintained for at least 10 years, with total sward dry matter yields of 10 – 11 t/ha/annum.
- The use of modern nitrogen-tolerant Aber varieties enables high clover content swards to be maintained even with nitrogen fertiliser levels up to 250 kgN/ha/annum.

Rotational Cattle Grazing

- Modern medium leaf varieties grown with compatible companion grasses can provide a total sward dry matter yield of 11 – 13 t/ha/annum.
- Longevity of the sward is determined by the companion grasses, with perennial ryegrass offering up to 8 years, hybrid ryegrass up to 3 – 4 years, and Italian ryegrass 2 – 3 years duration.
- Modern nitrogen-tolerant varieties perform well in swards receiving up to 250 kgN/ha/annum.
- Where swards are cut frequently (for silage) it is beneficial to include a proportion of the white clover content as large leaf varieties.

White Clover Developments

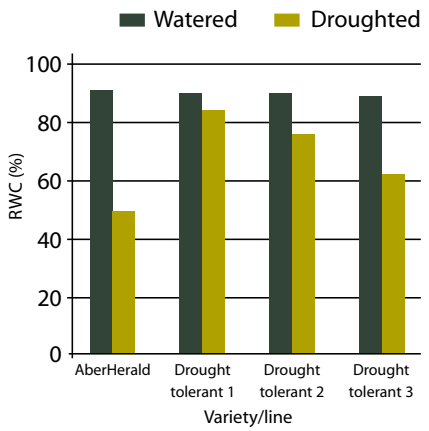
Plant breeders at IBERS, working as part of the latest Defra-sponsored Sustainable Livestock Production (SLP) LINK programme, are focused on a range of resource-efficient criteria in addition to more conventional breeding objectives.

Drought Tolerance

New varieties are emerging from the IBERS white clover breeding programme that are better able to cope with potential climate change scenarios. Improved drought tolerance has been introduced into the breeding programme through the development of hybrids between white clover and Caucasian clover (Trifolium ambiguum), a drought tolerant, rhizomatous species. These new varieties are white clover-like in appearance and combine the agronomic performance of white clover with the drought tolerance of Caucasian clover. A further potential advantage of these hybrids is better persistence of large leaved varieties under different management systems.

In the chart opposite, three new lines with improved drought tolerance are shown in comparison with the established white clover variety AberHerald.

Relative water content of varieties in watered and droughted conditions



Phosphorous Use Efficiency

Phosphorous (P) is one of the most important determinants of yield of grasslands. In response to concerns over future availability of phosphorous and the environmental impact it has in rivers and watercourses, the IBERS white clover breeding programme is developing varieties that are able to grow in low-phosphorous soils and to make better use of the nutrients available. New varieties are emerging from the programme offering the possibility of reducing fertilizer P inputs to swards.

Fertility Building

Many successful low-input and organic systems rely on a legume-based fertility building ley phase as an alternative to mineral N applications and there is increasing interest in using these systems more widely. White and red clover can both be used as fertility building crops in these systems.

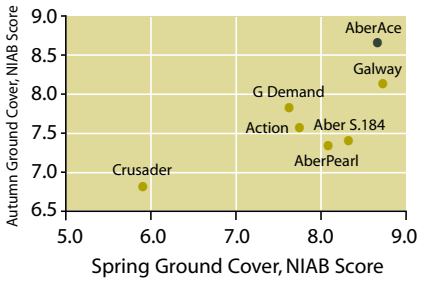
Variety choice

Aber White Clovers: Small Leaf Varieties

AberAce
Small leaf clovers such as AberAce are particularly useful under continuous sheep grazing. AberAce can also be used in blends with other varieties of differing leaf sizes and will provide a very dense base to any clover blend. Small leaf clovers are mainly used in long-term leys.

AberPearl
A very flexible variety, AberPearl should be used in all grazing situations, either for sheep or cattle. AberPearl is suitable for inclusion in long-term mixtures where persistence is key and can also be combined with other clover varieties of greater leaf size.

Ground cover under hard defoliation, NIAB 2011



Source: NIAB

Aber White Clovers: Medium Leaf Varieties

AberHerald
AberHerald is designed for use in rotational sheep and cattle grazing systems including cutting for silage. AberHerald is ideal for northern farms where spring growth is key, as its rapid growth characteristics allow it to perform despite shorter day lengths.

AberDai
AberDai is best suited to cutting or cattle grazing. It is very winter hardy and therefore highly appropriate in many parts of the UK. AberDai can be used where the ability to be flexible is key and can be used in either medium or long-term leys.

AberConcord
AberConcord is a very versatile variety and can be used in many situations. Due to its nitrogen tolerance AberConcord is a very useful variety on farms where there is a reliance on bought in fertiliser. AberConcord could be used for either cutting or grazing and is suitable for inclusion in either medium or long-term mixtures.

Aber Clover Management

Blend or Single Variety?

AberClover Blends offer the livestock farmer similar advantages to those that grass mixtures have over a single grass variety monoculture sward.

On most farms, environmental conditions and management systems can vary from year to year. Blends of the latest Aber white clover varieties combine complementary characteristics and offer greater stability of yield than single varieties. Blends also capitalise upon white clover's ability to re-colonise areas left vacant by more vulnerable plants, by means of its creeping stems (stolons).

AberClover Blends have been formulated for specific uses, taking into account the individual characteristics of Aber white clover varieties.

Aber grass and clover mixtures are offered as standard with a recommended AberClover blend. However, specific blends of white clover can be requested to suit a particular farming system or requirement.

AberDairy

Formulated from a combination of the medium leaf size Aber white clover varieties, providing a blend suitable for the dairy farm where high production is required under cattle grazing and cutting regimes. Good production from early spring provides a balanced sward and good support for high yielding companion grasses.

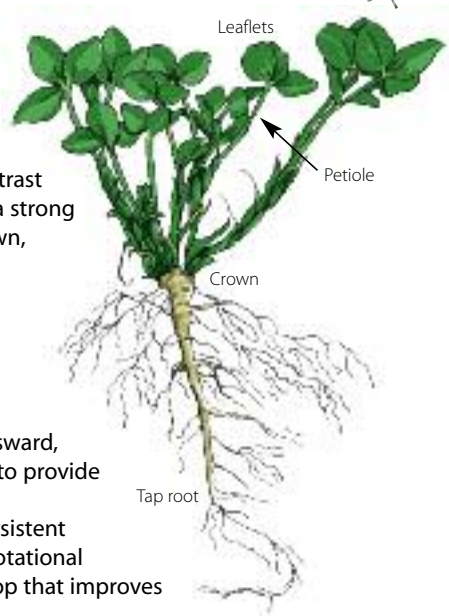
AberPasture

Selected Aber white clover varieties provide a unique blend of small and medium leaf size clovers selected for their suitability for cattle set stocking and rotational sheep grazing.

AberSheep

Small leaf size Aber white clover varieties combined with a medium leaf size variety provide a blend suitable for sheep systems ranging from continuous to rotational grazing on either upland or lowland farms.

Understanding Red Clover



The Plant

Red clover is a short-lived perennial herbage legume that typically persists for 2 – 4 years. In contrast to white clover, it has an upright growth form and a strong deep tap root from which finer roots arise. The crown, located at the base of the stem, acts as a store of nutrients. Differences in the size and reserve status of the crown affect persistency and suitability for particular management regimes.

Usage

Red clover is often grown as part of a grass/clover sward, but can also be grown as a monoculture, primarily to provide high yields of protein rich forage for conservation.
The development of more grazing tolerant and persistent varieties is creating the potential for red clover in rotational grazing systems, and it also has value as a break crop that improves soil structure and fertility.

Cutting and Grazing Heights

As the crown is above ground, damage must be avoided to ensure plant survival:

- Cutting height for all silage cuts should be 7 – 8 cm;
- Optimum grazing height of aftermaths or over winter is 4 – 6 cm;
- In wet weather, avoid heavy machinery and poaching.

Key Benefits of Red Clover

Nitrogen Fixation - Rhizobium bacteria exist symbiotically within red clover root nodules and produce available nitrogen, the same as white clover and other legumes.

High yields – Red clover swards are capable of producing 10 – 15 tonnes DM/ha/yr.

Feed Value – Protein content is particularly high in red clover, and – due to a form of biochemical protection – there is a reduction in protein loss in the silo. Feed value is greater than it appears on analyses due to the composition of the protein, and exceptional finishing results can be achieved (see page 21).

Break Cropping – Red clover has significant benefits as a break crop in mixed farming situations due to its ability to improve soil structure and soil nutrient status.

Monoculture or Companion Grass

Red clover is primarily grown in a mixed sward, but can also be grown as a monoculture. High sugar perennial ryegrasses and Timothy are potential companion grasses.

Advantages of growing red clover with a companion grass:

- Reduced impact of poaching.
- Improved nutritional balance (from Aber High Sugar Grass).
- Utilisation of fixed nitrogen by grass.

Intermediate and late heading Aber High Sugar Grasses at 20-24kg/ha (8-10kg/acre) with new Aber Long Term Red Clover varieties (e.g. AberClaret, see pages 22/23) at 7.5kg/ha (3kg/acre) have been shown to be an effective 3 – 4 year ley mixture providing high yields of quality silage followed by late season lamb grazing.

Italian ryegrass is most useful as a companion species in predominantly arable rotations where a 2 year ley is preferred.

Bloat Awareness

Red clover presents similar risks of bloat to white clover.

Management procedures to minimise or eliminate the risks of bloat are the same as for white clover.

Oestrogenic Content

Red clover typically contains high levels of phyto-oestrogens, particularly formononetin, which can cause a reduction in ovulation rates in ewes. It is therefore advisable to avoid grazing red clover varieties with ewes six weeks before and six weeks after tupping.

New red clover varieties with low levels of formononetin are being developed, offering the potential for greater flexibility in the use of this crop for sheep farmers.

Managing Red Clover

Successful Establishment

Targets
The aim when establishing a red clover ley is to achieve 200 plants per square metre by October in the sowing year.

Techniques
Red clover can be drilled or broadcast, and can be undersown to an arable silage crop in April. It can be introduced into an existing sward.

Timing
April – late July is the optimum sowing period on most UK farms.

Seedbed
A fine, firm seedbed is essential, and this should ideally be ring rolled prior to sowing.

Soil pH should be 6.0 or above. Liming to correct pH should be carried out well in advance of sowing.

Fertiliser nitrogen should only be applied in low N status soils, up to 50kgN/ha.

Phosphate (P_2O_5) and potash (K_2O) is required at application rates of 50 – 120 kg/ha, to achieve soil indices of 2+.

The height of a red clover sward should not go lower than 4-5 cm when grazed in order to avoid damage to the crown (inset)

Seed Rate and Sowing Depth
Monoculture swards should be sown at 15kg/ha (6kg/acre). Seed rate for mixed swards should be 7kg/ha (3kg/acre) red clover and 22kg/ha (9kg/acre) of hybrid ryegrass.

Optimum seed depth is 5 – 10mm, and should never exceed 15mm.

Clover rot (Sclerotina)

Stem eelworm damage

Combating Pests and Diseases

Clover rot (Sclerotinia) is the most important disease affecting red clover. This fungal disease, seen typically in December/January, causes a generalised rot of the crown, leaves and stems from which plants rarely recover. Clover rot cannot usually be controlled safely or economically in situ and hence a 5 – 7 year rotation is strongly recommended.

Stem eelworm is the most important pest affecting red clover and the most effective control is rotation. A five year break is recommended between red clover crops, and this should be extended to seven years if stem eelworm is known to be present.

Crown and **root rot** (typically caused by Fusarium) and powdery mildew also affect red clover, but are less devastating.

Agrochemicals for the prevention of pest and disease problems should only be used following advice from a qualified agronomist.

Weed Control

Adopt the same weed control measures as for white clover (see page 10)

Systems in practice

Conservation

- Graze swards lightly in the autumn of the sowing year.
- Four cuts at 6 – 8 week intervals yielding 13 – 14 tonnesDM/ha on fertile sites (10 tonnesDM/ha on upland sites).
- Cut when between 30 and 50% of flowers show red, for optimum quality.
- Ensile at 25 – 30% DM to minimise wilting losses.
- Avoid crown damage caused by low cutting height.
- Graze autumn re-growth lightly to finish lambs or cattle.
- No nitrogen, 100 – 150 kg/ha K_2O, 200-300 kg/ha P_2O_5.
- 3-4 years good yields achievable with modern varieties.
- Red clover in combination with Aber High Sugar Grasses results in a better fermentation.

Aber Clover Management

Grazing

- Aftermath grazing for sheep.
- Superior lamb growth rates from red clover compared with ryegrass.
- Red clover can be combined very effectively with Puna II perennial chicory (2kg/acre Puna ii + 3.25kg/acre red clover) for an outstanding lamb finishing mixture.
- Grazing in wet or moist conditions must be avoided to limit bloat and reduce poaching.

Organic

- Key conservation and fertility building crop for organic farms.
- Typically undersown to spring barley.
- Valuable break crop that improves soil nutrient status and soil structure.

Sward Renovation

- Potential for upgrading existing swards due to large seed and vigorous seedlings.
- Cost effective improvement of soil fertility and soil structure.
- Apply similar principles as for white clover.
- See Bronydd Mawr data on page 23.

Typical analysis of red clover/ryegrass silage

Metabolisable Energy	Up to 11.5 MJ/kg DM
Crude Protein	14 – 19%
pH	4.0 – 4.5
Ammonia Nitrogen	< 5% of total nitrogen

Lamb performance from grazed red clover or ryegrass

	Red Clover	Ryegrass
Growth rate (g/day)	229	182
Days to finish	40	49
Eye muscle depth (mm)	27.1	25.9
Subcutaneous fat depth (mm)	4.1	3.9
Cold carcass weight (kg)	18.8	17.7
Killing out percentage (%)	51	48

Source: IBERS

Red Clover Developments

The Re-emergence of Red Clover

Growing interest in safe, traceable homegrown protein - together with the continuing development of organic farming systems – has resulted in significantly greater demand for red clover in recent years. This situation is likely to continue as livestock farmers progress towards more sustainable systems and seek greater returns from homegrown forage.

This resurgence in the crop is being underpinned by a significant breeding commitment at IBERS following the recommencement of DEFRA funding in 1998. New varieties with greater persistency into a fourth year and beyond are now emerging.

Red Clover Breeding Objectives

The main objectives of IBERS' red clover breeding programme are:

- Greater overall persistency.
- Higher yields, particularly in the third year and beyond.
- Enhanced grazing tolerance, to allow greater flexibility in use (e.g. aftermath grazing).
- Improved resistance to pests and diseases, with emphasis on stem nematode (eelworm) and clover rot (Sclerotinia).
- Improved nutritional quality to enhance protein utilisation and reduce nitrogenous losses.
- Lower oestrogen content to reduce the potentially deleterious effects on ewe fertility.

Red Clover in the Uplands

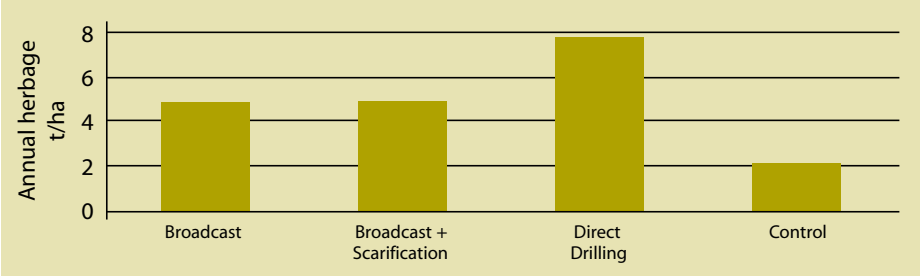
Studies at IBERS' Bronydd Mawr research farm on the edge of the Brecon Beacons indicate that red clover could have great potential on upland farms. Good yields have been obtained for up to five years from overseeding on upland pastures.

The increased persistence seen at upland sites is thought to be due to two particular features:

- Development of the crown closer to or beneath the soil surface, when compared with growth in the lowlands, which gives the plant greater stability and less vulnerability to cutting and grazing.
- Lower burden of pests and diseases than in lowland situations.

The Bronydd Mawr study has included work on overseeding establishment methods, which showed a yield benefit for direct drilling in the first two years. Yield differential between direct drilling and alternative methods (broadcast and scarify/broadcast) lessened in later years. In this study, AberRuby red clover was sown into a three year old hybrid ryegrass ley.

Red Clover Establishment at Bronydd Mawr (Year 1 and Year 2 mean, AberRuby)



Source: IBERS, Bronydd Mawr

Greater Persistency

One of red clover's shortcomings has been its relatively short persistence, typically remaining in the sward for just two to three years when a longer productive life would make it more compatible with medium term leys.

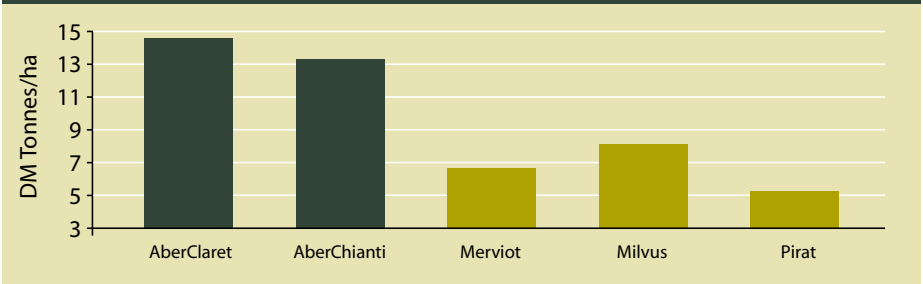
Aber Clover Management

Long-term trial plots at IBERS are now showing the results of breeding for longer-lived red clover, with fourth year data revealing new varieties that are still producing in the region of 14 tDM/ha.

Over the four years, the new material is totalling around 60tDM/ha compared with 40 – 45tDM/ha from the controls.

New varieties from the breeding programme, AberClaret and AberChianti, are the latest additions to the Recommended Lists.

IBERS - Fourth year yield data



Source: IBERS

Improved Nitrogen Use Efficiency

Other on-going work at IBERS is focusing on the impact of increased polyphenol oxidase (PPO) in red clover, an attribute that has the potential to reduce protein degradation and the resulting nitrogenous pollution. Improving the retention of protein in silage has increasing benefits for farmers seeking alternatives to expensive bought-in protein for their rations.

Variety choice

New Generation Aber Long Term Red Clovers

Bred and selected by plant breeders at IBERS, these new and unique varieties have been selected to last 4 years and longer in a cutting sward and to be significantly more tolerant of grazing by dairy animals.

Dry matter yields in IBERS trials were in excess of 14,000kg of dry matter in the fourth year and averaged over 13,500kg in each year of the trial.

IBERS' clover breeders understood that on many livestock farms a 2 – 3 year crop of red clover does not fit in with general rotations. Hence, by closely selecting plants for survival under grazed and cutting conditions, they have dramatically extended the life of red clover leys.

These Aber Long Term Red Clover varieties are a step forward in breeding and as such it is important to look at the companion grasses that are used.

To improve silage quality and to ensure that the grass also remains in the sward, the recommendation is to use Aber High Sugar intermediate and late perennial ryegrass varieties.

Greater persistence of red clover (right) is seen in these fourth year trial plots at IBERS Aberystwyth University

Aber Clover Management

AberClaret

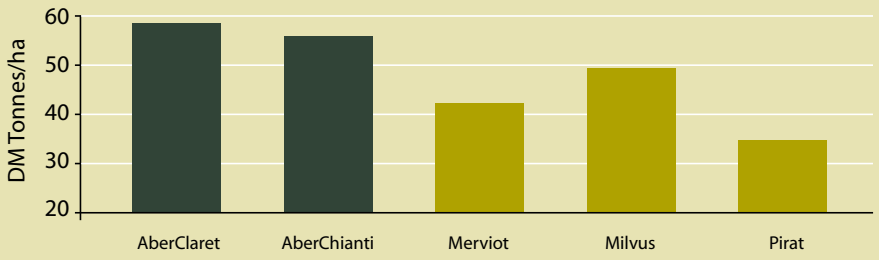
The first of the new generation Aber Long Term Red Clovers, AberClaret has been extensively trialled at IBERS over four harvest years, significantly out-yielding and out-lasting established varieties like Merviot and Milvus. AberClaret was the longest lasting variety still producing over 14.6 t DM per ha in year four.

AberChianti

The next variety form the Aber Long Term Red Clover production line at IBERS, AberChianti had an incredible yield of over 17 t DM per ha in year two and was still producing over 13 t DM per ha in year four.

AberClaret and AberChianti have been added to the NIAB Descriptive List. However these trials only last two years and do not reflect the true abilities of the Aber Long Term red clovers.

Total yield (4 years)



Source: IBERS

Mixtures for Optimum Ensiling Performance

Intermediate or late heading perennial ryegrasses are ideal companion grasses for conventionally cut red clover mixtures. Also, as red clover is relatively low in water soluble carbohydrates, using Aber High Sugar Grasses will increase the sugar levels overall and improve the ensiling process.

Example of compatible red clover mixture

3.5kg	Red clover (AberClaret)
2.0kg	AberMagic intermediate diploid perennial ryegrass (heading date 28th May)
3.0kg	AberAvon late diploid perennial ryegrass (heading date 2nd June)
3.0kg	AberBite late tetraploid perennial ryegrass (heading date 5th June)
11.5kg/acre	

Acknowledgements

White and red clover breeding is carried out as part projects sponsored by Defra through the Sustainable Livestock Production (SLP) LINK Programme in association with IBERS Aberystwyth University, Germinal Holdings Ltd, British Grassland Society, DairyCo, EBLEX, Hybu Cig Cymru (HCC), Livestock and Meat Commission Northern Ireland and Quality Meat Scotland.

Selecting your seed mixtures

Data in this publication has been derived from the NIAB Recommended Lists. The Recommended Grass and Clover Lists provide information on the best performing grasses and clovers currently available. Only varieties that have been independently tested by NIAB (or SAC in Scotland) and heavily scrutinised by a panel of experts to ensure they have genuine value to farmers make it onto these lists.

USE IT OR LOSE IT!

The industry is working hard to ensure continuation of the Recommended Lists as there is a real danger that testing work to maintain this valuable information source may cease. As a farmer, you can play your part by insisting on only buying recommended varieties for your reseeds.

Sefydliad y Gwyddorau Biolegol, Amgylcheddol a Gwledig
IBERS ABERYSTWYTH
Institute of Biological, Environmental and Rural Sciences

SAC

BGS

NIAB TAG

Find out more

A selection of technical guides and Farm Bulletins is available free on request from British Seed Houses.

Puna II Perennial Chicory:
Increased grazing potential for cattle and sheep.

Forage Brassicas:
Planning, growing and utilising forage brassicas for year-round costs savings and feeding solutions.

Aber Premium Mixtures:
Aber High Sugar Grass mixtures with Aber Clovers and Puna II Perennial Chicory.

Reseeding Grassland Farm Bulletin:
Using unique hybrid brassicas as a beneficial break.

All of the above can be viewed or downloaded from **www.bshagriculture.com** or can be obtained free of charge by contacting British Seed Houses at either Bristol or Lincoln using the contact details below.

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