

Clover

good for...

... the environment
... saving money
... animal performance

Useful contacts:

Farmers requiring advice should contact their local CAFRE Development Adviser based in the DARD offices* listed below:

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For information on grass and clover varieties, contact:
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*Offices subject to change

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At a time of considerable change in agriculture, and financial pressure on producers, it is important to consider every opportunity to farm using the most cost effective systems available.

High prices for nitrogen fertiliser increase the interest in the potential of modern clover based swards which do not require large inputs of inorganic fertilisers.

The Nitrates Directive has focused minds on the issues associated with the efficient utilisation of nitrogen from animal manures and slurries.

The use of clover based swards receiving slurry in the spring is compatible with maintaining a stock carrying capacity equivalent to grass swards receiving up to 150 kg nitrogen/ha/year.

Clover will increase animal intake and does increase liveweight gain.

The manufacture of nitrogen fertiliser uses large amounts of energy and produces considerable amounts of greenhouse gases.

White clover offers a means of replacing nitrogen fertiliser and reducing total greenhouse gas emissions, due to the lower levels of nitrogen fertiliser required in clover based systems.

Greenhouse gas reduction can be as high as 14% for beef production and as much as 25% total energy input can be saved by relying on white clover.

Clover is the most important pasture legume, and its use has been underexploited in recent years.

Clover swards are particularly suitable for grazing on many farms where low levels of nitrogen fertiliser are used. During the last decade nitrogen fertiliser usage on Northern Ireland beef and sheep farms was on average 120 kg nitrogen per hectare. An equivalent level of production can be achieved from clover based swards.

With the correct choice of varieties grass clover swards can be used successfully, not only for grazing, but also for silage production.

Clover based swards lose quality more slowly than grass swards, dropping about two units of digestible value each week. This contributes to greater herbage intake and:

- 10% improvement in beef liveweight gain;
- 20% improvement in lamb liveweight gain;
- 5% improvement in milk yields.

Milk protein levels and the proportion of muscle in the carcass can be enhanced. The risk of animal health problems associated with mineral deficiency is also reduced.

Sheep grazing the same area as cattle (mixed grazing) improve pasture utilisation and dilute worm burdens in both species.

Work in recent years has indicated that stock grazed on clover rich swards produce higher levels of certain essential fatty acids than stock grazing on grass swards.

Higher contents of linoleic, conjugated linoleic and α -linolenic acids, which are regarded as beneficial to human health, have been found in milk and meat from animals fed grass/white clover silage compared to grass silage.

Stock carrying capacity

The production of swards can vary from year to year, but clover based swards typically support up to 2 livestock units per hectare per year. This is equivalent to 2,000 - 2,400 kg

animal liveweight per hectare in the spring, declining to approximately 800 - 1,100 kg per hectare in the autumn.

Suggested stocking rate for grass/clover swards (including silage to support stock)

Beef cattle	6 cattle weighing approximately 350 kg/ha or 4 cattle weighing approximately 550 kg/ha
Sheep	10 – 15 ewes plus lambs per hectare or 25 – 50 weaned lambs per hectare
Dairy cows	2 cows per hectare

Animal Production

A well managed grass/clover sward receiving zero nitrogen can have the same stock carrying capacity and produce the same live weight or carcass gain per hectare as a grass sward fertilised with 150 kg of nitrogen per hectare. A summary of research findings indicates that swards receiving 50 kg N/ha and containing 10 - 20% clover can produce the same amount of

lamb or beef as a grass only sward receiving 180 - 200 kg N can produce.



When lambs are offered grass/clover swards their individual performance improves significantly.

Trials have shown that the performance of suckling lambs increases by 15%, from 246 g/day to 285 g/day and the performance of weaned lambs is boosted by a massive 60% from 80 to 130 g/day.



Mixed grazing

The optimum output from grass/clover swards is likely to be achieved when the proportion of sheep to cattle on the grazing area is 40% sheep and 60% cattle by weight.

For example:

- One spring calving suckler cow with 3 - 4 March lambing ewes.
- One 6 - 12 month old calf and one 12 - 18 month old steer / heifer with 3 ewes.



Dairy Production

Dairy heifer replacements will respond through increased rates of liveweight gain to grazing white clover and perennial ryegrass swards.

The benefits of increased liveweight gains from grass clover swards given a target calving weight of 580 kg at 24 months of age are best exploited through a reduction of concentrate feed use over the rearing period.

Concentrate savings can amount to 150 kg per heifer reared over a 24 month period through grazing white clover and perennial ryegrass swards.

Savings in nitrogen fertiliser use of 25 kg per heifer reared are also achievable through the nitrogen fixing activity of white clover.

Recent research findings at IGER, Aberystwyth, in Wales have shown 0.9 to 1.8 kg DM/cow/day increases in silage dry matter intakes from dairy cows fed mixtures of red

clover and perennial ryegrass silage, leading to 0.9 to 3.9 kg of increased milk output per cow per day.

Red clover combined with hybrid and perennial ryegrass grass varieties has the potential to produce similar or higher yields (12 - 15 tonnes DM/hectare) compared with conventional grass silage swards with minimal use of inorganic nitrogen fertiliser.

Red clover based swards offer the potential to reduce nitrogen fertiliser use by up to 225 kg N per hectare on up to 40% of the farm area used predominantly for silage production.

This equates to a saving in up to 14 tonnes of 27% N fertiliser for a 100 - cow dairy farm.

Bloat control

Whilst animals grazing clover rich pastures can be affected by bloat, this condition has not generally been a problem on farms in Northern Ireland. To reduce the risk of bloat, animals which are hungry should not be allowed to gorge themselves on clover swards.

If necessary, feed roughage, such as hay or straw, before moving stock

into fresh pasture. Grazing sheep ahead of cattle reduces the risk to cattle. Moving stock onto dry rather than wet herbage is also desirable.

Anti-foaming agents are available for prevention or treatment of affected animals. Severely bloated animals should be removed from clover swards and veterinary advice sought.



Choice of clover varieties

White clovers are classified according to leaf size:- small, medium, large and very large.

Small leaved varieties survive best under intensive sheep grazing, as they have a creeping growth habit. However, they can be expensive, and some varieties can, at times, be in short supply.

Medium leaved varieties are generally tolerant of a wide range of conditions and should always be included in mixtures intended for all grazing use.

Large leaved varieties are for general purpose use and are best suited in situations where some silage is taken, or for rotational grazing by cattle.

Very large leaved varieties are high yielding, but are least persistent under grazing and are best confined to hay or silage swards with only limited grazing use.

The best compromise is to use a blend of clover varieties, half of which should be medium leaved. The remainder should be either small, medium or large leaved varieties depending on the intended sward use.

Varieties such as Crusader, Chieftain and Barblanca grow earlier in the spring.

Appendix 1 shows the recommended white clover varieties for use in Northern Ireland.

Choice of companion grass for clover

Erect grasses are more compatible with white clover than dense prostrate types.

These develop a sward structure which will help encourage clover to spread.

Varieties need to be selected with care.

- Select erect varieties of perennial ryegrass, such as AberAvon, Spelga and Donard.
- Tetraploid varieties such as Dunluce, Garibaldi, Delphin and Navan may assist in maintaining an open sward, which should help to promote a higher clover content.

When reseeding on heavy soils, it may be worth replacing 2 - 3 kg of perennial ryegrass with timothy varieties such as Comer, Dolina or Motim.

When the primary use of a sward is silage, rather than grazing, the use of red clover with Italian and hybrid ryegrasses could be considered.

Establishing clover rich swards

There are several ways of achieving clover rich grass swards:

Direct reseeding following ploughing before the end of August is the most reliable method of establishing grass/clover swards. To ensure a good establishment of clover, be generous with the clover seed and economise on the grass seed.

The best compromise is 25 kg of perennial ryegrass with 4 - 5 kg of clover seed, sown at about 30 kg per hectare. The seedbed should be firm and fine and be rolled prior to sowing the grass/clover mixture.

Minimal cultivation represents an alternative to direct reseeding in that the technique does not involve ploughing. Spray off the old sward with glyphosate and after seven days cultivate the field with two passes of a power harrow. Alternatively, use a disc harrow with the discs set with minimum cut (coulters running straight) and add weight.

Disc the field in several directions to open up slits in the ground before sowing when soil conditions are dry. Roll after sowing to achieve good seed to soil contact, conserve moisture and ensure rapid germination.



Overseeding methods can be used to place seed into an existing sward. Techniques such as direct drilling using the Vertikator, very light cultivation followed by sowing with an air seeder such as the Einböck, or discing ground and broadcasting the seed have been used successfully.

In all cases it is essential that competition is minimised by cutting or grazing the sward tightly to 3 - 5 cm (1,600 - 2,200 kg/DM/ha).

In drier areas overseeding may be best immediately after a silage cut taken mid-July to late August, with soil conditions neither excessively wet or dry.

In wetter areas where soils dry out less, overseeding after the first silage cut is an option as there is less likelihood of a bone-dry June-July. The earlier sowing gives the clover a longer establishment period.

Slurry seeding may be an option in circumstances where the existing sward has become thin and in need of rejuvenation.

Key factors in reseeding

All the basic principles for any reseeding operation must be considered as part of an overall sward improvement programme, for example, adequate drainage, pH, alleviating soil compaction, fertility, weed and pest control.

Soil analysis to keep a check on soil fertility is worthwhile every three to five years.

Soil samples should be taken from any fields to be reseeded. Aim to maintain a soil pH status of 6.0 - 6.5.

Lime should be used to correct soil pH.

In addition to manure and slurry in an organic situation some natural sources of phosphate and potash, such as ground rock phosphate and rock potash, can be used to maintain soil fertility.

Note: - Rock phosphate requires justification based on soil analysis under Phosphate Regulations.

For successful clover establishment, by any method, there are some principles that must be adhered to:

- **Correct timing** - Late summer (August) is best for seed germination and full plant development before winter.
- **Proper soil fertility** - Soil phosphate and potash status should both be at least index 2 and soil pH should be between 6.0 and 6.5.
- **Good seed/soil contact** - Seeds need to be sown into a firm, shallow (1 - 2 cm) seedbed.

- **Control grass competition** - The existing grass sward cover must be kept low before and after seed sowing, otherwise the young seedlings will not survive.

Rejuvenating clover in existing swards

Provided clover is well distributed throughout the field, even though it may not be contributing much to sward productivity, it may be possible to encourage the development of a productive clover rich sward without the need to reseed.

To determine the suitability of a field for rejuvenation, there must be a high proportion of productive grass species present and a clover assessment should be carried out.

As you walk across the field you must see clover within 0.5 m of your foot in 8 out of every 10 inspections, preferably carried out every 20 paces over the entire area of the field.

If there is an even distribution of clover throughout the sward, adopt the management guidelines given below:

- Graze hard to 3 - 5 cm (1,600 - 2,200 kg/DM/ha) with sheep or light cattle during November/December.
- Avoid under-grazing during spring/early summer.
- Do not graze swards for 3 - 4 weeks during July, or close off for silage.
- Avoid poaching.
- Avoid smothering with slurry.
- Avoid spreading silage effluent.
- Control broad leaved weeds.



Sward management

Grass/clover swards must be carefully managed to ensure sustained high levels of herbage production.

In spring it is important to encourage grass growth with some form of nitrogen in slurry, farmyard manure or inorganic bag fertiliser.

As ryegrasses are particularly hungry, there is a risk of clover becoming over-dominant in the sward if grass is not encouraged in early spring.

However, too high a level of fertiliser will result in the grass dominating the clover, reducing the effect of fertility and feed value it provides.

Recent sward assessment work on farms has confirmed the view that the target should be an average clover content over the season of around 30% in the DRY MATTER (DM).

To achieve a level of 30% in the Dry Matter, the following targets for percentage GROUND COVER of clover should be met:

- 20 - 30% cover early in the growing season;
- Approximately 40% cover midway through the growing season;
- Peak of 50 - 60% cover in the latter half of the growing season.

The following photographs give an indication of what differing percentage ground covers look like in practice.



20-30% Cover



40% Cover



50-60% Cover

Management guidelines are similar to those for rejuvenating swards with low clover levels.

- Graze hard (3 - 5 cm) with sheep or light cattle during November/December.
- Apply 50 kg N/ha as inorganic fertiliser or slurry/farmyard manure in early spring to encourage grass.
- Avoid under-grazing during spring/early summer.
- Rest for 3 to 4 weeks during July or close off for silage.
- Avoid poaching.
- Avoid smothering with slurry.
- Avoid spreading silage effluent.
- Control broad leaved weeds.

Production from grass/clover swards with low levels of applied nitrogen can approach output from conventional ryegrass swards, in favourable conditions.

Annual P and K requirements of white or red clover/grass leys (kg/ha)

	Soil P/K index	0	1	2	3	4
Grazing	P205	60	40	20	0	0
	K20	60	30	0	0	0
Silage (3 cut)	P205	130	105	80	20	0
	K20	340	290	250	90	0

Some of the P and K can be supplied in manures/slurry for example, 40 m³ dairy cow slurry may supply 48 kg phosphate/ha and 140 kg potash/ha.

Weed Control

In direct sown swards, or swards undersown in an arable silage crop, topping or forage harvesting can control most annual broad leaved weeds, except chickweed, which spreads and smothers below cutter bar level.

Grazing with sheep, when the grass is 10 cm tall can provide a useful degree of control of annual weeds such as chickweed, redshank and hemp nettle. However, care must be taken to avoid overgrazing and poaching, especially when soil conditions are wet.

Chemical control of annual weeds in newly established grass/clover swards is best achieved by spraying as soon as possible, when both

grass and clover have reached the herbicide tolerant stage (usually when grasses have 2 - 3 leaves and when clover has one trifoliate leaf).

The following products are clover-safe and effective in controlling most types of seedling weeds.

Once grass and clover have reached a safe stage of development, choice of herbicide will depend on type of clover (red or white), time of year and the size and type of weeds present.

Proprietary name	Active ingredients	Weeds Controlled
Acumen	Bentazone +MCPA+MCPB	Seedling chickweed
Bellmac Plus	MCPA+MCPB	Wide range of annual weeds at seedling stage
Alistell	2,4-DB + Linuron + MCPA	Controls seedlings and established plants of chickweed, but slower in cold weather
Squire	Amidosulphuron	Docks

If spraying is necessary for weed control, ensure herbicides used are safe for clover (red or white clover as appropriate) and follow manufacturers' instructions carefully to avoid damage to the newly emerged clover.

All manufacturers emphasise that cold temperatures affect clover safety, so comply with all label recommendations and do not apply to frosted swards or when frost is anticipated.

In established grass/clover swards Asulam (Asulox) will control both curled and broad-leaved dock and give some control of ragwort, while thifensulfuron-methyl (Pinnacle) will control broad leaved docks. There are many non-clover safe products available, so care must be exercised.

Contact your local CAFRE Development Adviser for further information.

Pest and Disease Control

A number of pests can attack clover plants but routine control measures are often not considered worthwhile.

- Clover seedlings are prone to slug damage and when reseeded, slug pellets (metaldehyde) may be used if a slug problem is suspected.
- If large numbers of leatherjackets are forecast, or known to be present, treatment with a suitable insecticide (chlorpyrifos) will prevent loss of clover. Clover is even more susceptible to leatherjackets than grasses, although it will eventually recover after an attack.
- Avoid spreading undiluted silage effluent.

Red clover silage has a high crude protein content of 16% to 20% and a ME content of 10 to 12 MJ/kg DM, depending on the growth stage at cutting.

- Animal performance is increased in terms of milk yield, protein content or liveweight gain as a result of higher intake and better forage utilisation.
- Swards are relatively drought tolerant due to the deep rooting ability of red clover and are winter hardy.
- Red clover is suitable as a break crop to improve soil structure and fertility, and to supply organic matter.
- Lambs finish successfully on red clover grass aftermaths.
- Avoid grazing ewes on red clover for a period from four weeks before, until four weeks after, tupping to avoid any adverse effects on lambing percentage.

Forage potential of red clover

Red clover is better suited to silage production than white clover because of its much more erect growth habit and its significantly higher forage yields. It will not persist if grazed more frequently than every 30 days, due to a combination of excessive foliage removal and plant crown damage by hoof trampling.

Red clover will perform best on well drained, fertile soils with a pH of 6 - 6.5. Typical annual requirements (based on soil phosphate (P_2O_5) and potash (K_2O) indices of 2) for an annual yield of 12 t DM/ha/year would be 100 - 150 kg P_2O_5 and 250 - 300 kg K_2O /ha.

Typically, 80 - 90% of the annual yield is obtained from two silage cuts completed by late July-early August.

Slurry or well composted farmyard manure can be applied in early spring and between cuts, weather and ground conditions permitting. Cut the crop at the early bud stage around mid to late May and again

in late July, depending on rate of regrowth in mid summer.

Rest the sward in September and cut or graze off herbage in October, if this can be achieved without poaching. This will encourage branching and should improve sward persistence over winter. Severe winter grazing may damage the plant crowns directly by physical damage and indirectly through soil compaction.

Late flowering varieties are more tolerant of grazing, as they produce more buds from the plant crown. Lax grazing would be beneficial to red clover in mixed swards. Sheep can apply considerable grazing pressure as they can selectively graze the red clover, especially where herbage density is low.

Establishing red clover

Choice of red clover varieties

Most varieties currently available are early flowering. These have two main growth flushes during the growing season and start growth in spring, earlier than late flowering varieties.

Typical persistence is three years, ie two full harvest years after the establishment year.

Newer varieties may persist longer. Provided overall sward management is good, and sufficient nutrients can be applied, timely reseeding will result in swards rich in red clover for several years.

Choice of companion grass for red clover

Mixtures of red clover with grass will give higher total forage yield, dry matter content, water soluble carbohydrate concentration and metabolisable energy, than red clover dominant stands.

However, mixtures will have lower protein content and lower levels of some minerals, such as calcium and magnesium.

Competitive, short duration ryegrasses such as hybrid ryegrasses, make very suitable companion grasses for red clover silage swards.

Variety combinations need to be selected on the expected duration of the sward within the land rotation.

Making red clover silage

Red clover silage has a higher protein content and is often more palatable to cattle than grass silage.

However, red clover is characterised by low dry matter, low water soluble carbohydrate content and a high buffering capacity.

As a result, it is more difficult to obtain a satisfactory fermentation with red clover than with all-grass silage.

Suitable red clover silage making practices include:

- Devoting a maximum of 35 to 40% of the farm area to red clover swards predominantly for silage production.
- Harvesting in mid to late May.
- Cutting to a minimum stubble height of 7 - 8 cm to avoid crown damage to the red clover.
- Wilting for 24 - 48 hours in dry conditions to achieve 25% dry matter content to concentrate sugars, encourage a desirable

fermentation and reduce silage effluent production.

- Red clover wilted to 25% dry matter will often ensile effectively without an additive.
- However, when herbage is wet or where there is a very high proportion of red clover, an additive can be used to ensure a stable fermentation.
- Avoid over-wilting which can result in substantial leaf shatter and loss, and make it difficult to consolidate very dry material in the clamp.
- Lightly grazing silage aftermaths with young stock only to avoid poaching damage to the red clover crown.
- Re-juvenating red clover swards every 3 to 4 years.



Appendix 1 White clover varieties for Northern Ireland

VARIETY	Relative leaf size (% Huia)	Grazing Yield Potential t/ha/DM			Grazing persistence	
		Total 12.8 *	Clover 4.2 *	Grass 8.6*	Low N	High N

Small leaved

AberAce	39	91	55	108	6.5	4.7
AberGuard (P)	69	92	62	107	6.5	4.5
Glds. Demand	75	97	81	105	6.3	5.1

Medium leaved

AberDai	98	101	107	99	5.4	4.7
AberHerald	89	98	97	99	4.9	4.4
AberVantage	102	101	98	102	5.2	3.7
Avoca	92	101	100	101	5.9	5.0
Chieftain	104	104	124	94	5.3	4.5
Crusader	84	101	101	101	5.7	4.9
Glds. Bounty (P)	89	101	96	104	5.8	4.7
Glds. Huia	100	98	83	104	5.7	4.6
Menna	101	100	96	103	5.5	4.4

Large leaved

Alice	126	102	111	98	5.1	4.2
Barblanca	126	104	121	95	5.6	4.6

Very large leaved

Aran (S)	152	101	116	94	4.3	3.3
Triffid	131	102	104	101	5.2	3.9

*=Average yield of 'Bold Type' varieties in t/ha DM
(S) = Specific use (P) = Provisionally recommended