Grassland reseeding guide

Contents

Acknowledgements
This guide has been written by contributors from AHDB and Dr Debbie McConnell of AFBI and Dr Debbie McConnell of AFBI.

Photographs courtesy of ADAS, Bayer CropScience (Fritfly image), Germinal, Irish Farmers Journal, Oliver Seeds, SAC.

Introduction

Reseeding is an important part of grassland management on any farm and is essential for maintaining productive grassland.

At a cost of £400–700 per hectare, it is important that it is done correctly. This booklet is a best-practice guide for reseeding to help achieve the best return from farmers' investments.

The reseeding survey was conducted by AHDB during 2016 with technical assistance from Field Options. There were 121 usable responses and these were analysed. Selected results have been reported in this guide.

For more information on grassland management, visit ahdb.org.uk

Why reseed?

Well-managed grass is the cheapest feed for ruminants. Renewing pastures regularly is important to maximise productivity and maintain feed quality.

Reseeding survey results

The top five reasons for farmers to reseed, were:

- Part of the reseeding programme – 25.2%
- Part of the arable rotation – 15.5%
- Drop in yield – 14.7%
- Too many broad-leaved weeds – 13.4%
- Drop in sown grasses – 10.1%

Research has shown that increasing the proportion of the farm reseeded each year increases the amount of grass grown and used on the forage platform, resulting in increased farm net profit (see Figure 1).

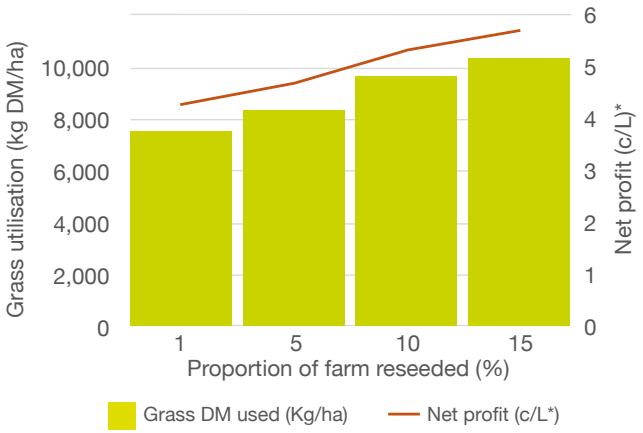

Figure 1. Results from research work on Irish dairy farms on the benefit of reseeding on net profit *cents/litre

Reseeding survey results

The average percentage of farm area being reseeded was 11.8%, with a range of 4.2% to 50%.

The average amount being reseeded was 10 ha, with a range of 1.5 ha to 222 ha.

Reseeding:

- Improves pasture yield and quality, driving higher farm output and reducing bought-in feed requirements
- Addresses soil compaction problems
- Introduces improved grass genetics, with enhanced productivity, durability and disease resistance
- Reduces weed burden
- Increases pasture response to fertiliser, through using more nitrogen-efficient varieties
- Introduces clover into the sward

Typically, the benefits of a new ley, which include improved yield, quality and disease resistance, can last five to ten years over an existing sward. However, over time, these benefits will decline.

The rate at which this happens and the requirement to reseed will depend on:

- **Nutrition** – maintaining sward's nitrogen, phosphate, potash and sulphur requirements
- **Soil health** – maintaining correct soil pH and avoiding compaction
- **Weed control** – maintaining an appropriate weed control programme
- **Grassland management** – reducing ingress of native species (e.g. meadow grass, creeping bent), which are of lower production and nutritional quality

Table 1. The progress of a grass reseed

PRG content (%)	Production (t DM/ha)	Herbage ME (MJ/kg DM)	Lost ME grown (MJ/ha)	Milk equivalent of lost ME (litres/ha)	Meat equivalent of lost ME* (kg LW/ha)	Concentrate cost to replace lost ME^ (£/ha)
95	13.5	12.0				
90	12.6	11.8	13,320	1,885	133	197
80	11.2	11.5	33,200	4,698	332	491
70	9.8	11.3	51,260	7,254	513	759
60	8.4	11.0	69,600	9,849	696	1,030
50	7.0	10.8	86,400	12,226	864	1,279

ME = Metabolisable energy *assuming 100 MJ per 1 kg of gain for 350 kg growing cattle ^based on 1.4p per MJ of ME
PRG = Perennial ryegrass DM = Dry matter

Is a reseed needed?

Some farmers may opt to reseed a set proportion of the farm each year, e.g. 10% or 15%, in a rotational pattern to ensure grass swards are regularly renewed.

There can be large variation in the performance of paddocks across the farm, so the best way to identify swards eligible for reseeding is to measure grass growth regularly to identify the poorest performing fields.

Using a plate meter, nine Irish dairy farms measured grass throughout the season 2014.

The results showed wide variation in the performance of individual paddocks, varying by 28% (see Table 2).

Using regular grass measuring can highlight fields that need attention and may require a full reseed.

Table 2. Variation in paddock performance on 9 Irish dairy farms

Farm number	Mean growth (t DM/ha)	Highest paddock (t DM/ha)	Lowest paddock (t DM/ha)
1	11.7	14.1	8.7
2	14.3	16.8	11.0
3	12.3	20.3	7.2
4	14.4	17.8	8.8
5	12.4	15.8	9.0
6	11.0	14.3	8.9
7	9.9	14.8	7.5
8	10.8	12.2	6.0
9	10.1	14.2	5.4

Reseeding should be considered if two or more of the following criteria have been met:

- Sward productivity has fallen significantly
- Proportion of sown species has fallen below 60%
- High levels of native grasses and weeds are present
- Significant evidence of soil compaction, especially at depth

Reseeding survey results

The top five weeds listed as problems before reseeding, were:

- Thistles – 31%
- Docks – 26%
- Buttercups – 15%
- Chickweed – 11%
- Nettles – 9%

Why reseed?

Pasture improvement flow chart

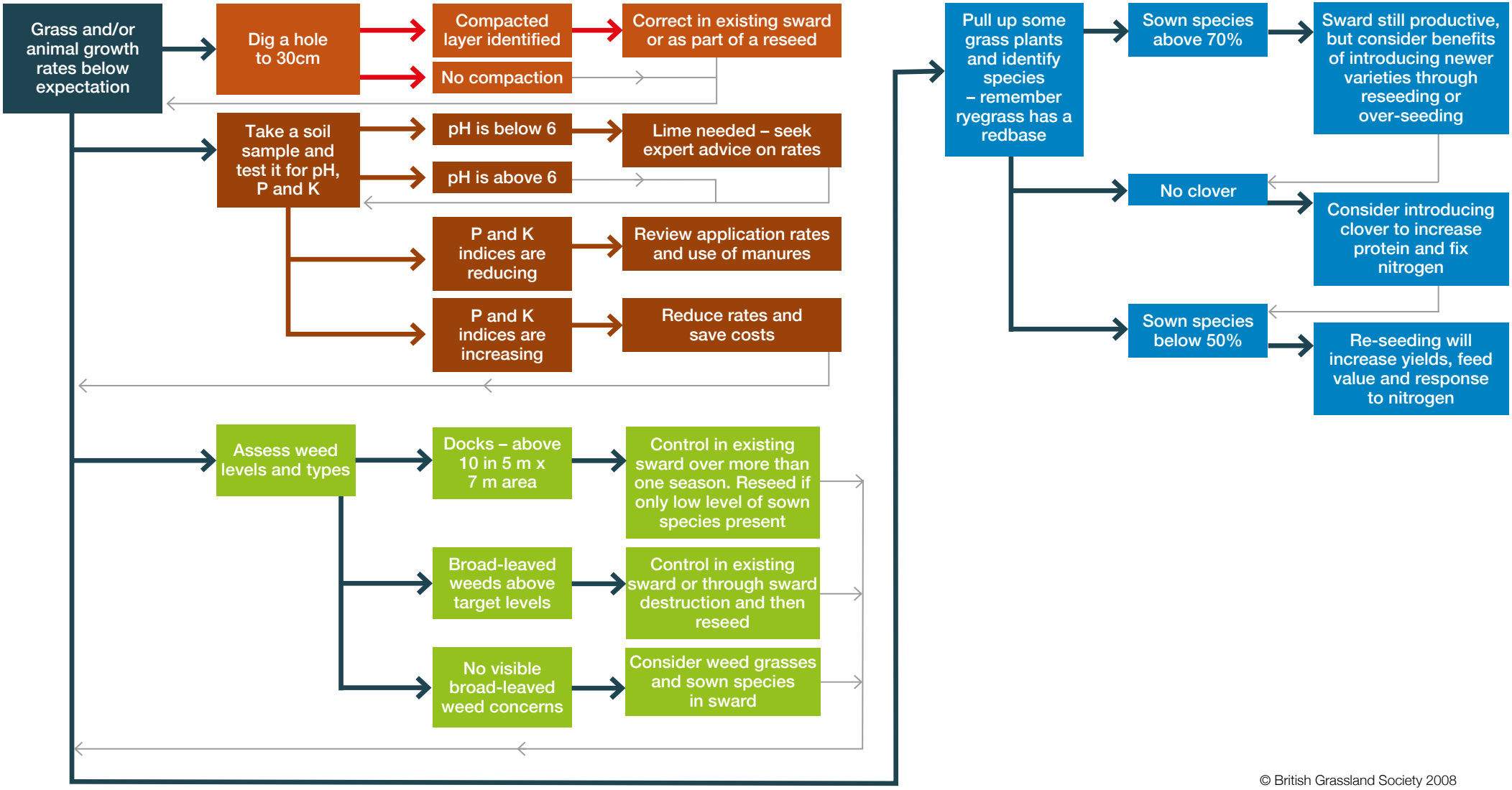

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Figure 2. Decisions around reseeding

Preparing for a reseed

Six months before reseeding, it is important to check the following:

Make sure the field drainage system is working and fit for purpose

- Look for wet areas and indicator species such as rushes
- Clear drainage ditches and ensure all outflows are working correctly
- More information can be found in the AHDB Field drainage guide

Soil test the field

- Walk the field in a 'W'. Avoid gateways and feeding areas
- Twist a sampling auger/soil corer down to 15 cm (if planning to plough) or 7.5 cm (if only cultivating the surface)
- Collect 25 plugs of soil in a bucket and mix well, take out a subsample
- Seal the soil in plastic bag, and label
- Send the sample to a soil laboratory (via local co-op, fertiliser merchant or independent company)
- Sample at least two months after the last application of manure, fertiliser or lime

Assess the soil structure

Use the four steps of the ***AHDB Healthy Grassland Soils Pocketbook***

1. Surface assessment
2. Soil extraction
3. Soil assessment
4. Soil scoring

If the soil scores 1, 2 or 3, a 'minimum-till' reseed rather than ploughing may be sufficient. However, if the soil scores 4 or 5, then ploughing would be recommended (see Figure 3).

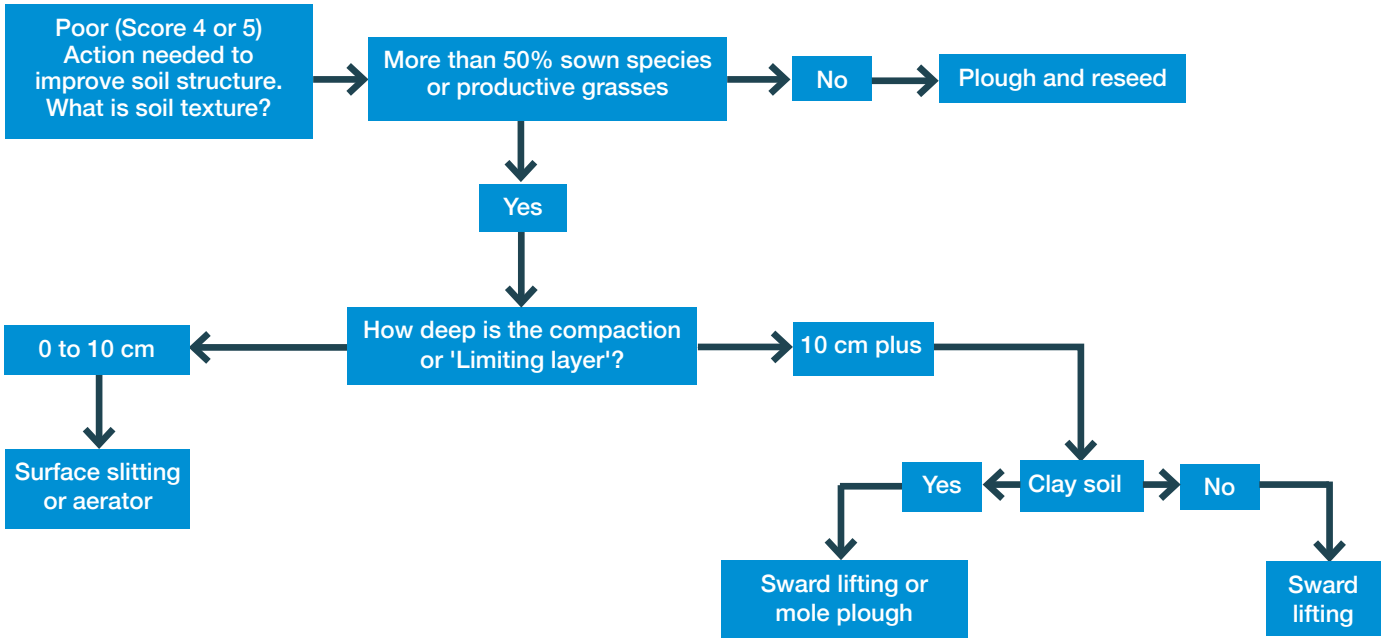


Figure 3. Decision tree to aid in decision-making if soils score poorly (from ***AHDB Healthy Grassland Soils Pocketbook***)

When to reseed – autumn or spring?

Successful establishment can be achieved in spring and autumn, and there are pros and cons to both times. In each case, there needs to be significant soil moisture to assist germination. The timing should be planned to minimise the effect of yield loss by taking an area of land out of grass production (see Table 3).

It is important to make sure soil conditions are correct before proceeding.

Table 3. The pros and cons of spring and autumn reseeding

	Spring	Autumn
Pros	Greater window of good conditions for establishment No heading in first season Better opportunity to outcompete weeds	Minimal impact on yield loss Seedbed has time to settle over the winter, allowing good structure to form
Cons	Lose peak growth Shorter window for soil to settle before carrying stock	Weed competition can be significant with late reseeds Narrower window of good establishment conditions

Reseeding survey results

Around 66% of respondents reseeded in the autumn (August to October), with 30% reseeding in the spring (March to May). The remainder reseeded in June and July.

The need for a break crop

A break crop, such as stubble turnips or kale, can be used to avoid a grass-to-grass reseed. It can help to break any pest cycles and also provides useful additional feed if used well. There must be a clear plan of how the break crop will be established and used to ensure it is cost-effective.

Using a break crop within a field classed as permanent pasture, i.e. more than five years old, will change it to temporary grassland within the Basic Payment Scheme.

More information on using brassica crops as a break crop can be found in Beef and Sheep BRP Manual 6 ***Using brassicas for Better Returns*** from **ahdb.org.uk**

Reseeding survey results

Only about 8% of reseeds were following brassicas. The three most common previous crops were permanent grass (33.3%), cereals (21.6%) and temporary grass (17.1%).

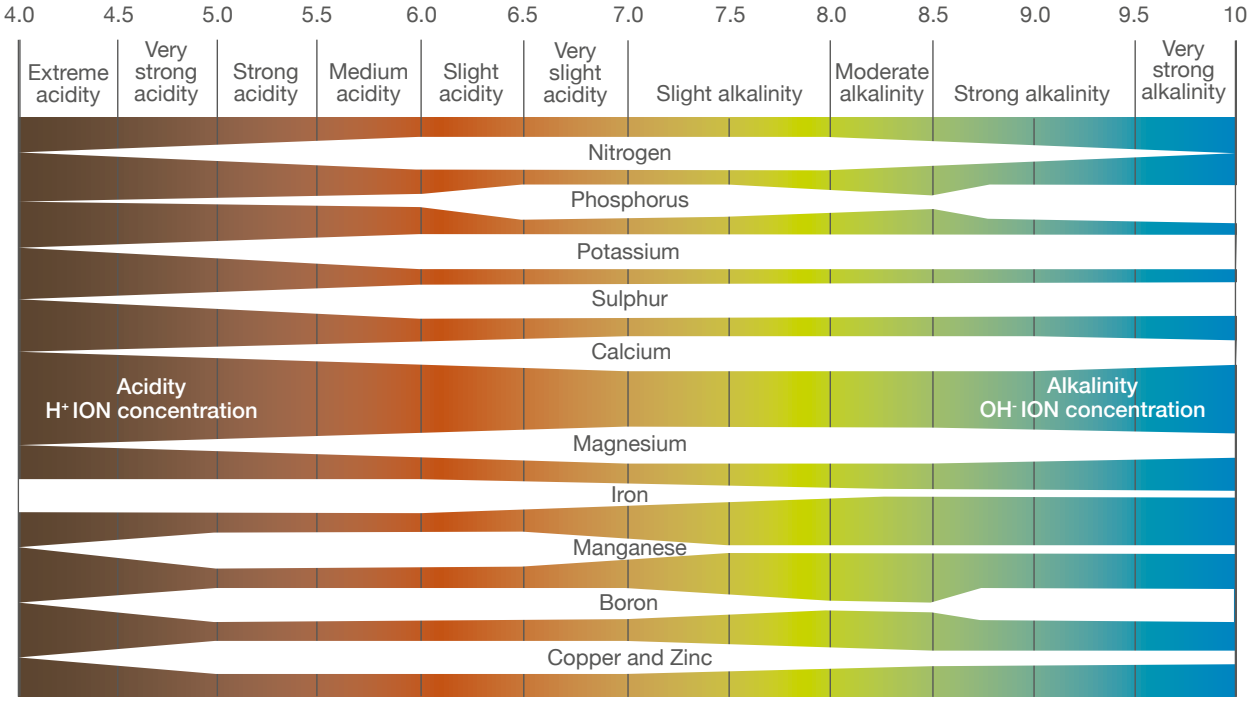


Figure 4. The availability of nutrients at a range of pH

Liming

Soil pH has a strong influence on the availability of nutrients in soil. Reseeding provides a perfect opportunity to correct pH imbalances and gives the new ley the best chance of establishment.

The optimum availability of most plant nutrients in soil occurs over a small range of soil pH values (see Figure 4). For continuous grassland, pH values between 6.0 and 7.0 are thought to be sufficient to maximise nutrient uptake. There is limited evidence to justify increasing the pH beyond 6.5.

Over time, grassland soils have a tendency to become more acidic due to rainfall, decay of organic matter and fertiliser. Data taken from across the UK shows that 57% of grassland soil samples are below pH 6.0, which has knock-on effects on nutrient availability.

Lime is also important in minimum-till reseeding because it neutralises the organic acids released by the old sward as it decays. The amount of lime required will depend on the current soil pH, soil texture, soil organic matter and the optimum pH needed. Typically, clay and organic soils require more lime than sandy soils.

An online calculator is available at **www.aglime.org.uk** to help calculate field lime requirements.

Reseeding survey results

The average pH reported in the survey was 6.2, with a range of 4.0 to 8.2. Respondents who were applying lime used, on average, 4.4 tonnes per hectare.

Table 4. Lime recommendations in terms of tonnes of lime (NVSO) to apply per hectare

Initial soil pH	Sands and loamy sands		Sandy loams and silt loams		Clay loams and clays		Organic soils[a]		Peaty soils[b]	
	Arable	Grass	Arable	Grass	Arable	Grass	Arable	Grass	Arable	Grass
Liming factor										
	6	4	7	5	8	6	8	6	16	12
t/ha										
6.2	3	0	4	0	4	0	4	0	0	0
6.0	4	0	5	0	6	0	6	0	0	0
5.5	7	3	8	4	10	4	10	4	8	0
5.0	10	5	12	6	14	7	14	7	16	6

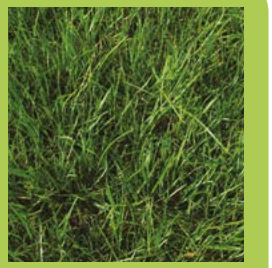
a For mineral and organic soils, the target soil pH is 6.7 for continuous arable cropping and 6.2 for grass.
b For peaty soils, the target soil pH is 6.0 for continuous arable cropping and 5.5 for grass.

To estimate the lime recommendations (in t/ha of ground limestone or chalk), multiply the liming factor for each soil type and land use combination by the difference between the initial (measured) and target soil pH.

Choosing the correct grass species

Currently, most reseeds are a mixture of diploid and tetraploid perennial ryegrasses. However, other types of ryegrass and species such as clover, cocksfoot and timothy may have a role to play in certain situations. Each type of grass has different growth and quality characteristics (see Table 5). When reseeding, it is important to select the most appropriate species for the situation.

Perennial ryegrass (PRG)



- Most effort by plant breeders has concentrated on PRG
- Establishes rapidly, even from autumn sowing
- High yields in first harvest year
- High sugar content makes it good for silage-making
- Produces dense and persistent swards and is useful for long-term leys and establishing permanent pasture

Italian ryegrass (IRG)

- Produces heavy crops of silage or hay
- Useful for short-term leys of one to three years
- Long growing season gives opportunity for 'early-bite' grazing, followed by leafy hay or silage cut

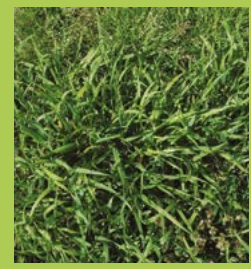
Hybrid ryegrass

- Better ground cover and longer lived than IRG
- Good winter hardiness and disease resistance
- Mid-season digestibility better than IRG, but poorer than PRG
- First-year yields lower than IRG, but yield improves in second and third year
- Potentially more drought-resistant than IRG

Timothy

- Grows at lower temperatures than ryegrass, so can be good for early season grazing, especially in cold, late springs
- Good mid-season growth can fill the gap when ryegrass growth falters
- Good winter hardiness and ground cover
- Can be slow to establish and yields are likely to be lower than PRG
- Best used in cooler, wetter areas

Cocksfoot



- Drought-tolerant
- Hard-wearing
- Good summer production, especially in dry conditions
- Lower quality than PRG

Diploids and tetraploids

Tetraploids have twice the number of chromosomes than diploid varieties, increasing the size of the plant's cells. They have larger seeds and leaves, and tend to establish quickly. They are also more able to compete when overseeding pastures.

Tetraploids have a more upright growth habit and are suited to drier growing conditions. Diploids are more persistent and tiller more freely, producing denser swards than tetraploids. They are generally better suited to wetter growing conditions.

Reseeding survey results

% of respondents that used each species:

Perennial ryegrass – 28%

Hybrid ryegrass – 13%

Italian ryegrass – 11%

Timothy – 11%

Cocksfoot – 4%

Table 5. Summary of the typical performance of different grass species

	Perennial ryegrass		Italian ryegrass		Hybrid ryegrass	Timothy	Cocksfoot
	Diploid	Tetraploid	Diploid	Tetraploid			
Grazing DM Yield (t/ha)	10.5	10.5	-	-	-	11.4	-
Grazing D-value	75.9	76.3	-	-	-	72.1	-
Silage DM Yield (t/ha)	15.2	15.5	18.1	18.2	16.3	13.8	15.3
Silage D-value	73.4	73.7	70.8	71.8	70.7	64.3	70.5
Ground Cover (1 = poor, 9 = good)	6.6	5.8	3.8	6	4.2	5.3	6.3
Winter Hardiness (1 = poor, 9 = good)	6.5	6.7	6.8	7.0	7.1	7.0	5.5
Suitable for:	Five to six-year leys Grazing Silage		Two-year leys Silage		Three-to-four-year leys Silage Rotational cattle grazing	Wetter soil Extensive grazing	Dry soils Silage

Table 6. The improvements in yield and quality due to breeding

	Gain per year (%)		Gain in total DM yield (t/ha)	Financial gain over five years (£/ha)
Perennial ryegrass	Silage	0.35	1.6	224*
	Grazing	0.51	2.8	308^
Italian ryegrass	Silage	0.37	2.5	350*
Hybrid ryegrass	Silage	0.26	1.0	140*

*silage valued at £140/t ^grazed grass valued at £110/t

Selecting varieties

Over the past 40 years, breeding programmes in the UK have improved both the yield and quality of ryegrass varieties. In addition to increases in yield (see Table 6), grass digestibility is estimated to have increased by 10 g/kg DM.

Similar to livestock breeding, these improvements mean there is a significant financial return by using the latest grass genetics.

Variety selection is a key component in any reseed. Choosing the varieties best suited to individual fields is important, to maximise the return on investment.

There are more than 900 perennial ryegrass varieties available in Europe, so it is important to distinguish which ones will perform the best on the farm.

Reseeding survey results

The top five characteristics that are important when selecting varieties for reseeds, are:

- **Quality (D-value, measure of feed digestibility) – 25.7%**
- **Total yield – 19.3%**
- **Density/ground cover – 17.0%**
- **Early spring growth – 15.4%**
- **Heading date – 11.9%**

There are three key steps to selecting varieties

Step 1: Is it on the Lists?

When selecting grass mixtures, check that the varieties listed are present on the latest version of the ***Recommended Grass and Clover Lists*** (RGCL).

In the UK, the RGCL are drawn up after rigorous testing for attributes such as yield, persistency, quality and disease resistance. Varieties are tested at sites across England, Scotland, Wales and Northern Ireland, across a number of years, to provide information on their performance over a range of climates and soil types.

From this testing, the best-performing varieties are selected. As few as one in 20 varieties tested actually make it to full recommendation, classified as (G).

An interactive list of the RGCL can be found at **ahdb.org.uk**

Reseeding survey results

Nearly 70% of the respondents used the RGCL to select mixtures.

Step 2: What will the sward be used for?

Individual varieties can perform better under silage than grazing management and vice versa. It is important to consider whether the reseed will be mostly cut or mostly grazed, as selecting the correct variety for use can have a significant impact on financial returns.

Reseeding survey results

More than 65% of the respondents selected mixtures for grazing and cutting, with about 13% selecting mixtures for cutting only and 13% sheep grazing only. Approximately, 9% were being used for cattle grazing only.

For example, diploids Moira (heading date – 24 May) and AberChoice (heading date – 10 June) perform very differently under silage and grazing management (see Figure 5), resulting in differences of approximately £100/ha in yield.

The RGCL testing programme provides specific data for all varieties for both silage and grazing management.

There is more information on the performance of individual varieties in the ***RGCL Merchants' Guide*** found at **britishgrassland.com** or **ahdb.org.uk**

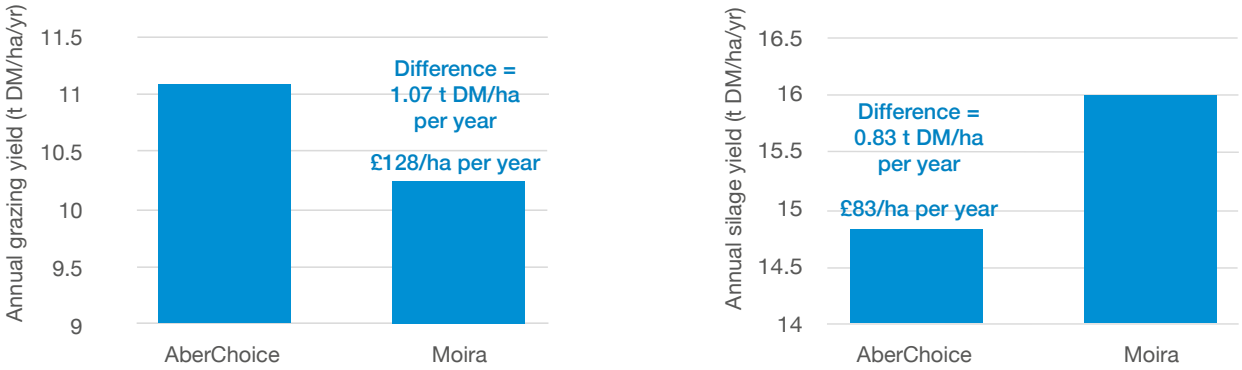


Figure 5. The comparison of two varieties for grazing and silage performance

Selecting for grazing specific swards:

- Choose top-performing varieties under grazing management in the RGCL
- Select varieties with high digestibility
- In wetter areas, choose varieties with higher ground cover
- Match seasonal growth of variety to grazing demand (see Step 3)
- Later heading grasses tend to perform better in grazing than silage swards
- Aim for a maximum heading date range of 15 days
- Aim for a maximum tetraploid content of 20% on wet soils

Selecting for silage specific swards:

- Choose top-performing varieties under silage management in the RGCL
- Aim for a maximum heading date range of seven days
- Earlier heading grasses tend to perform better in silage swards
- Choose varieties with high digestibility

Step 3: Choose which traits are most important for the farm

Once the purpose of the ley has been chosen and a subset of varieties identified from the RGCL, individual traits most important to the farm should then be considered. Varieties are also tested for attributes such as seasonal growth, ground cover and disease resistance.

Seasonal growth

The seasonal growth of individual varieties is strongly influenced by heading date. Early heading varieties produce higher yields in spring, with late-heading varieties exhibiting the highest yields in summer and autumn (see Figure 6).

However, within heading date classes (early, intermediate, late), there are large differences between varieties. Farmers seeking to maximise the use of grass at the shoulders of the season should consider varieties with high spring and autumn grazing yields.

Ground cover

Varieties are assessed for ground cover in autumn using a scale of 1 to 9 where 9 equals good and 1 equals poor. This gives an idea of the density of the sward.

Ground cover is also measured in the second and third harvest year, to provide an indication of variety persistency. Typically, diploids will have better ground cover rankings and are more suitable for wet soils or soils prone to poaching.

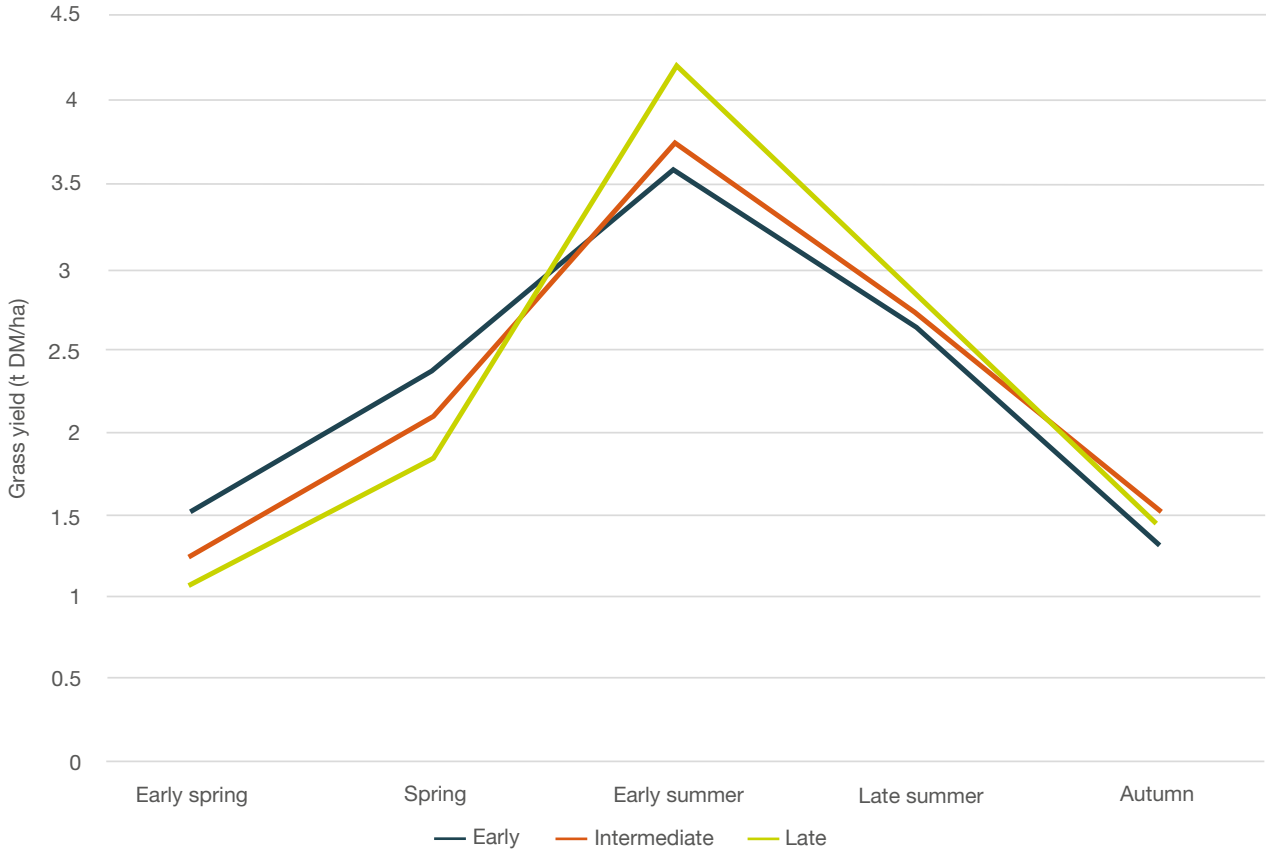


Figure 6. The variation in timing of yields based on heading dates

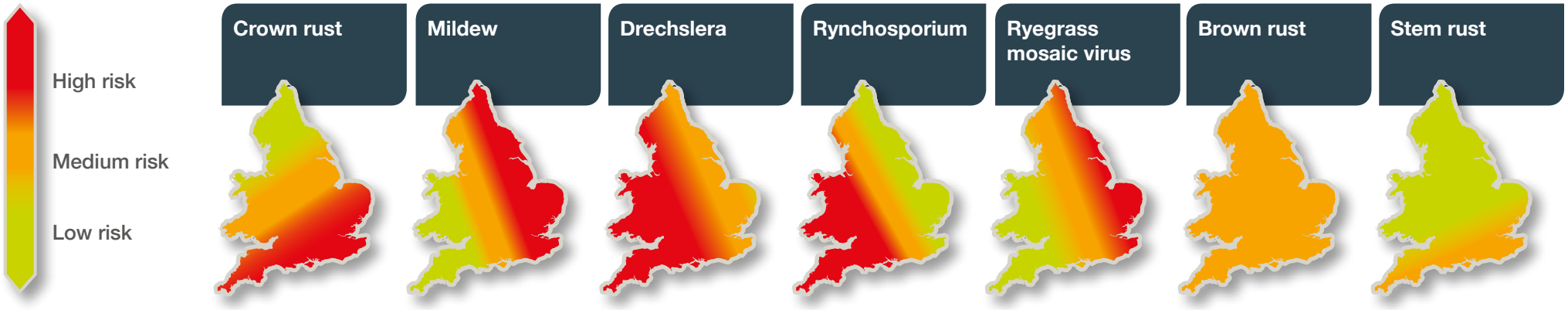


Figure 8. The risks of disease based on location (from ***RGCL Merchants' Guide***)

Winter hardiness

Winter hardiness is assessed by scoring grass plots for ground cover after their first winter.

Varieties with a greater winter hardiness ranking are more tolerant to hard frosts and cold soil temperatures. Winter hardiness is ranked on a scale of 1 to 9, where 9 is good and 1 is poor.

Disease resistance

Disease resistance is scored on grass plots during the autumn. It is reported on a scale of 1 to 9, where 9 is good and 1 is poor.

There are a number of plant diseases that can affect yield, quality and sward composition in ryegrass leys. Responses to fungicide treatments have been varied, but it is estimated that disease can cause crop losses of over 1 t DM/ha over a three-year period. In addition, diseases such as mildew and rhynchosporium in Italian ryegrass have been shown to reduce D-value by 1–2 units.

Depending on the farm's location, varieties can be selected with good resistance to these diseases.

Reseeding survey results

Nutrient-efficient grass varieties

With rising fertiliser costs and a greater focus on reducing losses to the environment, improving the efficiency with which nutrients such as nitrogen and phosphorus are used is becoming increasingly important in livestock systems.

Recently, researchers at Aberystwyth University have been working on developing grass and clover varieties that use nutrients more effectively. These include:

- Clover plants with a lower requirement for phosphorus
- Grass plants with a higher water-soluble carbohydrate content to improve nitrogen use efficiency in the rumen
- Red clover with higher polyphenol oxidase, an enzyme that can protect protein from degradation and so will reduce nitrogen losses to the environment

Drought-tolerant grass and clover varieties

Grass and clover roots have an important role to play in balancing soil water stores. Root channels are often used for water flow during the winter months, reducing the chance of flooding on the soil surface.

Meanwhile, during drought conditions, good rooting capability ensures growth rates remain high. Scientists at Aberystwyth are working to develop new grasses and clovers with better rooting structures, to enable them to capture increased volumes of rainfall in winter months and survive drought conditions in summer months. More information can be found at **sureroot.uk**

The grass research is focusing on Festulolium, which is a hybrid between fescue (meadow or tall) and ryegrass (perennial or Italian).

Formulating grass mixtures

Most grass leys are sown as a mixture of diploid and tetraploid ryegrasses, perhaps with a small amount of other species such as clover or timothy.

Mixtures are commonly sown for three reasons:

- Risk management – to minimise the risk of a crop of seed failing
- To ensure sward quality throughout the grazing season
- To achieve a balance of desirable traits

Reseeding survey results

More than 78% of the respondents selected standard mixtures. About 40% of respondents felt confident when selecting mixtures, with about 27% relying on someone else to make the decision.

Do mixtures yield more?

Studies undertaken in Northern Ireland have shown that, over a three-year period, under simulated grazing (in year two) and silage management (in years one and three), there was little difference between the annual DM yield of nine varieties grown as straights or in a range of mixture combinations (see Table 6).

Table 6. Results from experiments in Northern Ireland comparing straights and mixtures

	Straights (t DM/ha)	Mixtures (t DM/ha)
Year 1	13.0	12.8
Year 2	10.5	10.6
Year 3	12.2	12.0
Year 4	11.9	11.8

However, heading date is important when considering mixtures. When varieties with close heading dates are sown together, this increases competition between varieties, resulting in an increase in DM yield compared with the average yield of the component varieties sown separately. In contrast, mixtures with a wide heading date range have a lower yield than the corresponding weighted average of their components.

Mixture dynamics

In the first year after sowing, most mixtures are likely to change in their composition from what was sown. Early studies suggest that, in mixtures managed for grazing, later-heading varieties become more dominant, while, in silage mixtures, the contribution of earlier-heading varieties tends to increase.

In addition, mixtures with a greater heading date range will change more than those with a smaller heading date range. However, much remains unknown about mixtures and how these changes can be minimised through variety selection and management.

Some key tips for selecting mixtures, include:

- For grazing mixtures, choose varieties with a heading date range less than 15 days
- For cutting mixtures choose varieties with a heading date range less than seven days
- Open-growing diploids tend to be more aggressive than dense-growing diploids, when sown with tetraploids in a mixture
- Have a minimum of 3 kg of an individual variety in a mixture

Clovers

Choosing clovers

White and red clovers provide a good source of protein (>25% crude protein (CP)) in ruminant diets, both when grazed and conserved, and have high intake characteristics, as the D-value is 75–82.

There is the added benefit of nitrogen fixation by the clover plants, so less artificial nitrogen fertiliser is required for grass growth. Clover-rich swards fit well into forage or arable rotations and benefit soil fertility and structure.

Red vs. white

White clover is a perennial legume. The key to its survival and production potential is its multi-branched creeping stem (stolon), which provides sites for new leaves, roots and flowers. The stolon stores carbohydrates and proteins, giving the plant the ability to overwinter and regenerate in spring.

Red clover is a short-lived perennial legume that typically lasts for two to four years. In contrast to white clover, it has an upright growth habit and a strong, deep taproot.

Red clover is typically higher yielding than white. Historically, it has been much less persistent than white and as a result was used only in cutting leys.

Improvements in management and variety breeding have meant that, with care, red clover can now be grazed by cattle without killing the plant. Red clover can also be used as a break crop in mixed farming systems due to its ability to improve soil structure and soil nitrogen supply.

Reseeding survey results

About 22% of respondents sowed white clover and nearly 8% sowed red clover.

Big vs. small

White clovers are categorised on leaf size. Larger-leafed varieties tend to be higher yielding but are less tolerant of grazing and compaction. If selecting varieties for cutting, choose large-leafed varieties for maximum yield. If selecting for cattle grazing, choose medium-leafed sizes and for sheep grazing choose small-leafed varieties.

Choosing varieties

In contrast to white clover, which has a Recommended List of varieties, there are fewer sowings of red clover varieties, so the data of all varieties are presented in a Descriptive List. More data are currently being gathered on red clover varieties with a Recommended List available in 2018. Currently both lists are available at **britishgrassland.com/rgcl**

For more information on selecting and managing clover, download the BRP manual ***Managing clovers for Better Returns*** from **ahdb.org.uk**

How to cultivate

Achieving a level, uniform seedbed is important to ensure a consistent sowing depth. It is vital to select the right technique to suit the farm and soil conditions.

Under correct conditions, the impact of reseeding technique on sward productivity is small. Recent research undertaken in Ireland has shown comparable yield benefits to reseeding with discing, one-pass cultivation and ploughing (see Figure 7).

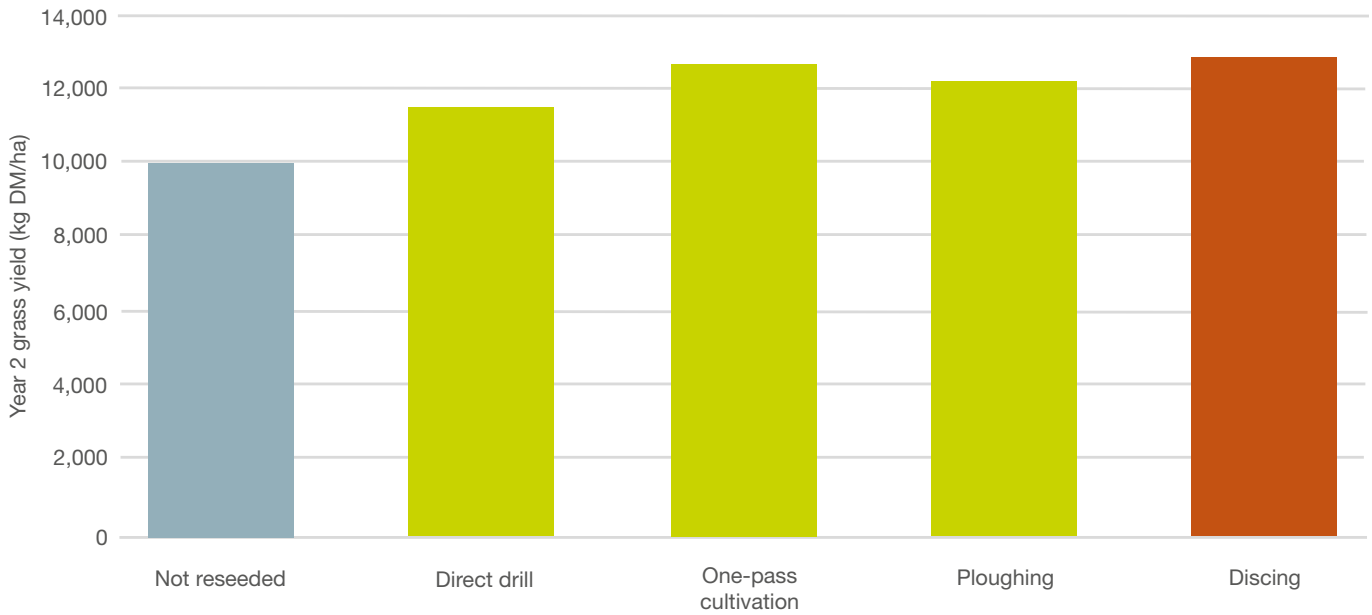


Figure 7. Results from Irish work on the impact on cultivation technique on grass yield

(Source: Creighton et al. 2012)

Reseeding survey results

About 46% of respondents ploughed and cultivated, another 19% cultivated but did not plough. Around 12% surface-seeded, with about 10% using a direct drill.

Cultivation technique can be selected based on various factors, such as soil type and existing sward conditions (see Figure 8). The cost of the technique needs to be taken into consideration (see Table 7).

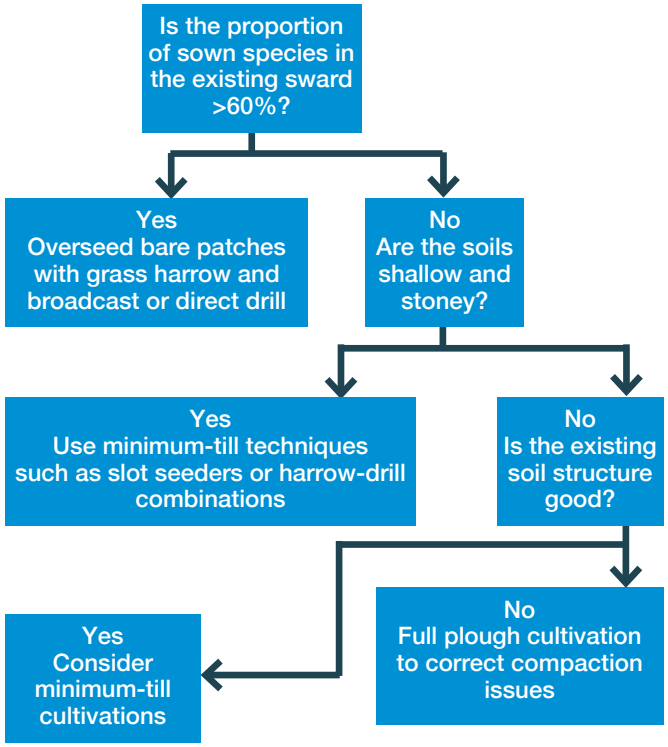


Figure 8. A decision tree for choosing a cultivation technique

Table 7. Example costs of different reseeding techniques (£/ha)

	Full cultivation	Minimum-till cultivation	Overseeding
Soil analysis	3	3	3
Spray	30	30	
Spraying	27	27	
Plough	61		
Power harrow	50	50	
Power harrow	50		
Land leveller	17	17	
Seed	161	161	79
Sow	22	79	79
Roll	17	17	17
Fertiliser - 100 kg 18:14:14 + spreading	94	94	94
Lime - 2 t + application	126	126	126
Leatherjacket control	12	12	12
Slug pellets	20	20	20
Total cost (£/ha)	689	636	430

Each of the techniques has a number of advantages and disadvantages (see Table 8).

Table 8. The pros and cons of cultivation techniques

	Full cultivation	Minimum-till cultivation
Ploughing	Good seed soil contact Can remove compacted layers in topsoil Achieves level, even seedbed Buries pests and trash Most reliable method	Expensive due to the number of cultivations Deep ploughing removes nutrient-rich soil from surface Light soils can dry out quickly Disturbs seed bank of weeds in soil
Minimum cultivation, e.g. discing, one-pass	Cheaper than full plough Fertile soil remains at surface Limited disturbance of soil structure	Difficult to remove trash Decaying trash can release organic acids hindering germination Takes longer to achieve an even, level finish across field
Direct drill into existing sward	Opportunity to maintain existing sward No cultivation reduces costs No disturbance of soil structure	Hard for cultivars to compete against existing sward Not suitable for dry, hard ground Results can be variable

Ploughing top tips

- Take time to set up the plough
  - Check manufacturer's specifications for tyre pressure to minimise wheel slip but avoid compaction
  - After the first pass, check the right furrow depth is being achieved and the plough is working at 90° to the ground, turning the sod over completely. By doing this, good contact can be maintained with the soil below the sod. This can avoid a plough pan forming and keep water and air moving down through the soil profile
  - The front furrow width should also be checked to ensure even furrows at each pass
  - Throughout the operation, regularly check the correct furrow is being achieved
  - Consult manufacturer's instructions for fine tuning plough set-up
- Avoid ploughing too deep (>15 cm), as this will move the fertile soil below the root depth
- Secondary cultivations should be carried out promptly to achieve a crumbly structure and consolidate the seedbed, to reduce drying out of the topsoil

Minimum cultivation top tips

- Graze tightly or mow to minimise the trash generated
- Applying lime prior to cultivation will neutralise any organic acid released from the trash
- Take time to set up the cultivator
  - Check manufacturer's specifications for tyre pressure
  - After the first pass, check that the optimum depth of soil disturbance is being achieved
- Cultivate in multiple directions across the field to achieve maximum soil disturbance
- Chain harrows may help remove excess trash
- The slower the forward speed of the machines, the better the finish
- Cross drill in multiple directions for a denser sward

Overseeding top tips

- Select times of year when existing sward is less aggressive, e.g. early summer
- Preparing areas with a chain harrow can help improve seed-soil contact
- Graze sward tight or mow to reduce competitiveness of existing grass
- Avoid applying nitrogen as it will boost existing sward
- After seeding, roll or harrow
- Be aware of areas prone to slug infestation

Cultivation and germination

The primary aim of any reseed cultivations is to provide the perfect environment for a seed to germinate. This means:

- Good seed-to-soil contact
- A fine seedbed with good soil structure to ensure a good supply of oxygen to support root development
- Retaining sufficient moisture for seed germination
- A weed-free seedbed

Pre-cultivation spray

Before reseeding, applying herbicide to the existing sward can remove any existing weeds and reduce competition for the new ley.

Trials undertaken in New Zealand achieved a plant count of 400 plants/m^2 in the reseed when using a pre-cultivation herbicide. This was reduced to 120 plants/m^2 when the herbicide was omitted.

It is important to allow sufficient time between herbicide application and sowing the seed. Contact between the seed and chemical may negatively affect germination rates. Cultivations can usually begin seven to ten days after spraying, but it is important to check the product recommendations.

Reseeding survey results

About 58% of respondents treated the existing sward with glyphosate.

Always wear appropriate protective clothing and take care when handling pesticides. More information can be found at: **hse.gov.uk/pesticides**

The pesticide legislation has changed. Everyone applying pesticides is required to have a certificate of competence and the sprayer must have passed a test. More information can be found at: **voluntaryinitiative.org.uk**

Formulating grass mixtures

Preparing the seedbed

An appropriate seedbed can be achieved using a variety of tools, such as power harrows, chain harrows, discs and levellers. Regardless of technique, it is important to ensure:

- A fine, crumbly tilth is achieved. If soil aggregates are too large, the seed will fall too deeply into the soil to germinate
- The seedbed is properly consolidated to achieve good seed-soil contact and avoid it drying out
- The soil is cultivated to the appropriate depth. It can be sufficient to have the second cultivation pass shallower than the first, e.g. a power harrow at 10 cm and then 5 cm depths can give a firm seed bed
- The seedbed is level to ensure an even drilling depth

Seed rates

From the moment of sowing, which typically involves 15–25 million individual seeds per hectare, there is huge competition among seedlings.

In a good establishment, 15–25% of the seedlings that have germinated will survive the first three months. After a year, only 10–15% of plants tend to survive. A mature, stable sward typically has 300–400 plants per square metre.

Seed rates for grassland establishment vary from 18–35 kg/ha. Traditionally high seed rates have been used as an insurance policy to reduce the risk of weed infestation or compensate for poor emergence rates. These can occur because of uneven sowing depths, variation in seedbed quality or low soil moisture levels hindering germination.

Recent work from New Zealand has suggested that when ryegrass is sown at lower seed rates, such as 6–18 kg/ha, competition for resources such as light, soil and water are reduced. As a result individual plants produce a greater number of tillers, generate more lateral roots and overall were larger.

Eight months after sowing there was no difference in yield between high and low sowing rates. However, the long-term effects on persistency were not evaluated.

Typically broadcasting seed can result in better ground cover of the sown species. However, in dry areas or on light soil, drilling into a prepared seedbed can ensure the seed is placed in contact with soil moisture. In these conditions seed rates can be reduced by one third.

Reseeding survey results

The average seed rate used by the respondents was 14 kg per acre or 35 kg per hectare.

Sowing depth

Although seeds can germinate at any soil depth, a shallow sowing depth is critical for successful establishment. As the plant has limited energy stores in the seed, the seedling needs to reach the soil surface and start to produce leaf material in as short a time as possible before it runs out of energy.

For best results aim to sow seed within 1–2 cm of the soil surface. For very small seeds, such as clover, a sowing depth of less than 1 cm is necessary to ensure emergence.

At depths of 5 cm only 20% of seedlings reach emergence three weeks after sowing. In addition, of the seedlings that make it to the soil surface from this depth, they are much slower to tiller than those planted closed to the soil surface.

Rolling

Consolidation of the seedbed after drilling is extremely important as it helps to ensure good seed-to-soil contact, reduces water loss and may help control pest issues.

Reseeding survey results

About 50% of respondents used a Cambridge roll, and 46% used a flat roll, with the remainder using both. Over 40% of respondents rolled the field more than once.

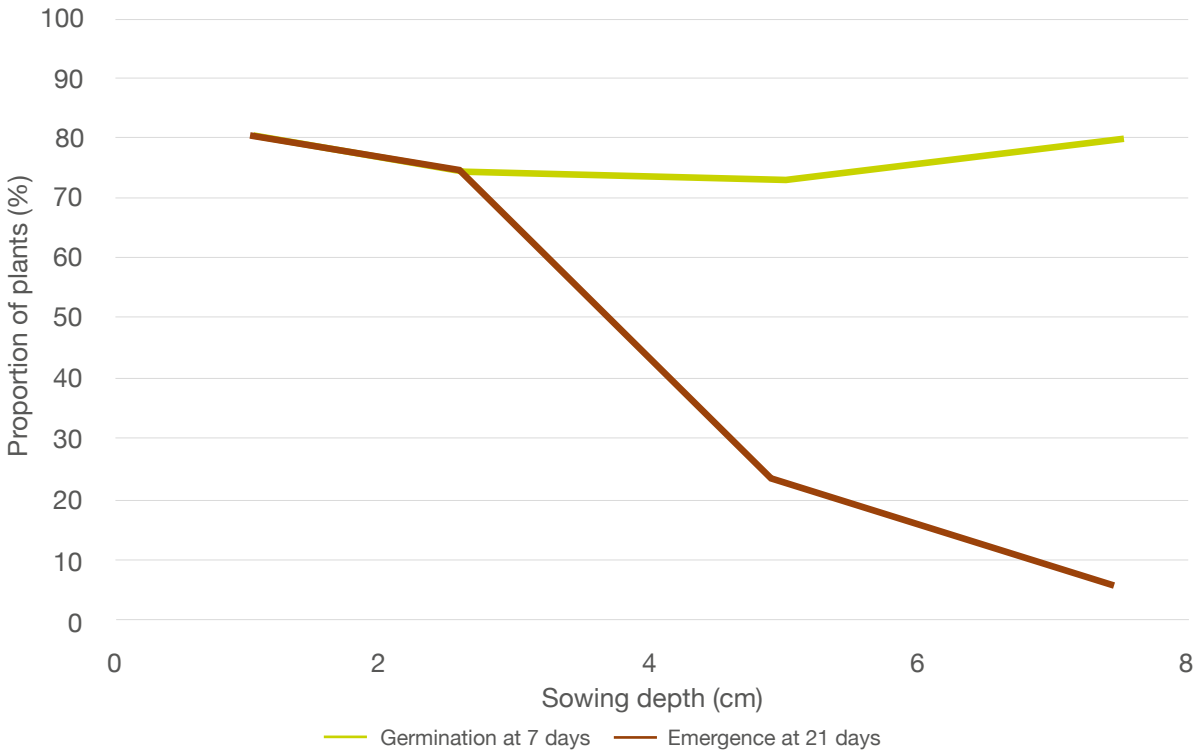


Figure 9. Results of an experiment investigating the impact of sowing depth on the germination and emergence of plants

Figure 10. The process of germination

Nitrogen

Nitrogen (N) is a key element in aiding grass establishment. However, during the early stages of plant growth, N requirements are quite low. Applying too much N may encourage regrowth or competition from existing seedlings.

For autumn sowings, high soil mineralisation rates over the growing season can mean that no N is required at establishment. For spring establishment, apply 60 kg/ha N due to low soil N stores (see Table 9).

In the fields that have low to moderate Soil Nitrogen Status, some N could be applied for summer- or autumn-sown swards (see Table 9).

This may be followed up with 30–40 kg N/ha four to six weeks after reseeding as plant N requirements increase.

Table 9. Nitrogen requirements for establishing grass swards

	Soil nitrogen supply (kg N/ha)		
	Low	Moderate	High
Spring sown (April–June)	60	60	60
Summer- or autumn-sown (July–mid-October)	30–50[a]	0–30[a]	0
Grass and clover swards	0	0	0

a. Nitrogen is important when rapid grass growth is needed, e.g. when seedbed conditions are suboptimal or seed is sown late. Nitrogen should not be applied where it will stimulate weed growth (e.g. in weedy stubbles) or seedling competition (e.g. direct-drilled into an existing sward). Be aware of nitrate vulnerable zones closed periods.

Avoid urea applications to recently limed fields, as the interaction between the compounds can result in higher levels of nitrogen being lost as ammonia gas.

Table 10. Phosphate and potash recommendations for establishing new leys

	Phosphate or potash index (kg N/ha)				
	0	1	2	3	4 and higher
Phosphate	120	80	50	30	0
Potash	120	80	60 (2-) 40 (2+)	0	0

Phosphate and potash

Phosphate and potash are essential for cell development and growth. New leys often require phosphate and potash to stimulate good root development (see Table 10).

More information on fertiliser requirements for grass establishment can be found in the ***Nutrient Management Guide*** (RB209).

Reseeding also provides a good opportunity to incorporate organic manures into soil. This adds organic matter, provides a food source for soil organisms and assists with the development of good soil structure.

Reseeding survey results

Around 30% of respondents applied farmyard manure (FYM) prior to reseeding and around 11% applied slurry. The average rate was 25 t/ha for FYM and 29 m^3/ha for slurry.

Management of new reseeds

Assessment post-drilling

It is important to monitor new reseeds so any problems can be resolved quickly.

Reseeding survey results

More than 70% of respondents inspected the new reseed more than three times in the first six weeks. More than 80% and 65% of farmers rated establishment of grass and clover, respectively, as good or excellent.

The most common issue was being able to see tread marks from tractors (42.5%), bare areas (42.1%), variation between headland and rest of the field (37.5%) and stripes (18.4%).

A newly sown sward takes about 11 months to fully establish. During this time, it is important that the sward is encouraged to tiller as much as possible and is protected from any damage.

Tiller development

Once a plant has germinated and the third or fourth leaf appears on the main tiller, daughter tillers will start to appear. These will eventually form leaves and roots and will allow the plant to spread and the sward to thicken.

An established perennial ryegrass sward typically contains 5,000–7,000 tillers/m^2 (see Figure 11). This helps to create a dense sward, minimising soil damage and reducing space available for weed infestation.

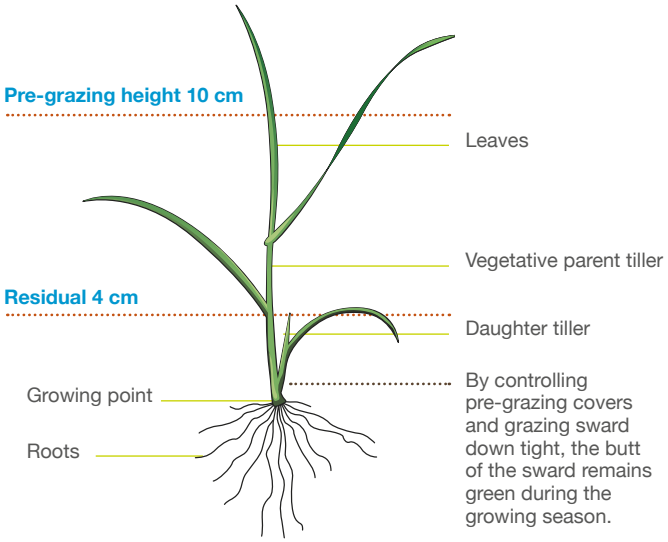


Figure 11. Diagram of a tiller

Sward management

The tillering process in new swards is strongly aided by grazing. Grazing removes the existing leaf and encourages a new generation of tillers to emerge at the base of the sward. Under continuous stocking regimes, a stable population of small tillers develops. Although rotational grazing encourages a slightly lower tiller population, individual tiller size and growth rate are greater.

Avoid cutting silage swards in the first six months because it does not encourage the sward to tiller.

First grazing

Graze the new reseed as soon as it is not possible to pull the plants out of the ground by hand. This is usually at the two-leaf stage or when the grass has produced about 2,200–2,500 kg DM/ha.

Use sheep or youngstock for the first grazing to minimise any potential soil compaction, particularly in wet conditions.

Reseeding survey results

Nearly 80% of respondents grazed the reseed between 10–15 cm (around 2,200–2,500 kg DM/ha). Sheep were the most popular class of stock to graze for the first time, with 61% of respondents using them.

The most common weed issues after reseeding were chickweed (36.0%), with docks (19.1%) and thistles (16.9%) being in the top three. Approximately 38.3% of respondents used herbicide and about 30% used grazing to control weeds.

Following grazings

Aim to graze autumn reseeds before the first winter to encourage tillering.

Teagasc work suggests grazing at about 6–8 cm in the autumn, but making sure it is grazed tight (4 cm) before the winter. The challenge is to do this without overgrazing or poaching, and the lightest class of stock available should be used.

Do not apply excessive slurry.

Dealing with pests

Frit fly

Frit fly populations are found across most of the UK and can pose a threat to summer and autumn reseeds.

Frit fly lay their eggs on grass during July to October. The larvae, which are yellowish-white, grow to 5 mm in length. These larvae move from one ryegrass seedling to the next, feeding on the central shoot and leaving patches of stunted or dying seedlings. Populations in new sowings can reach several thousand per square metre and exceed the number of seedlings present.

Risks

- Italian ryegrass is more susceptible than perennial ryegrass or clover. Timothy and cocksfoot are not affected
- Grass-to-grass reseeds
- Autumn reseeding is particularly prone to frit fly attack
- Direct-drilled swards are most at risk

Control

- Introducing a summer break crop such as brassicas can reduce frit fly burden
- Reseed outside the main egg-laying period (July–October)

Leatherjackets

Leatherjackets are the larvae of crane flies (daddy-long-legs). They are up 50 mm long, dull green in colour and have tough, rubbery skin.

Crane flies lay their eggs between July and September in both grass and cereal crops. The larvae live in the soil, eating the roots and stems of grass plants, at or below the ground surface. This causes significant damage to the sward base.

The most severe damage occurs when leatherjackets are almost fully grown and active in April and May. Crane flies tend to lay their eggs close to where they emerge, creating a persistent problem for the field.

Risks

- Grass-to-grass reseeds
- Highly productive grasses
- Mild, wet autumn favours survival of eggs and larvae

Control

- Using a break crop or a minimum of a two-week break from grass to grass leys
- Rolling to consolidate soil can minimise short-term damage
- Ploughing grassland in July can reduce leatherjacket populations by 50%

Slugs

Slugs graze grass leaves, rasping away the leaf tissue in strips between the veins.

The grey field slug is the most common type of slug that breeds throughout the year when conditions are correct. Wet summers encourage significant population growth.

Risks

- White clover and grass/clover reseeds are at greater risk of slug attack
- Slot seeding can increase slug damage
- Wet land or cloddy, unconsolidated seed beds provide a habitat

Control

- Ploughing can reduce the risk of slug damage
- Creating a fine, firm seedbed with no cracks allows slugs to be exposed
- Slug pellets are an effective method of control. However, for products containing metaldehyde, extra care must be taken to prevent chemicals reaching waterways

Weed control

As any form of soil cultivation can disturb the weed seed bank, it is important to check new leys regularly for any signs of weed infestation.

Weeds are best controlled in new leys when the grass is at the two-to-three leaf stage. However, spot control of docks and chickweed at the seedling stage can be important.

For more information on dealing with pests and weeds, consult a BASIS adviser.

voluntaryinitiative.org.uk/legislation/sustainable-use-directive/grandfather-rights/

voluntaryinitiative.org.uk/schemes/nsts/

Weed	Growth habit	Control measures
Chickweed	Chickweed is an annual plant that poses a real threat to autumn reseeds It originates from seed that has lain dormant in the soil Its rapid growth can quickly shade out seedlings of newly sown species	Heavy grazing with cattle or sheep can be used to eradicate chickweed, although the newly sown ley must be able to withstand this pressure Harrowing may be effective in more established swards; topping is not effective Herbicides containing fluroxypyr and florasulam are suitable for grass-only swards Herbicides containing tribenuron-methyl are suitable for swards containing clover
Docks	Dock seeds can last up to 25 years in soil and germinate rapidly after soil disturbance Docks have a deep tap-root and, once established, are hard to remove Mature plants can produce up to 60,000 seeds per year, posing a significant long-term challenge	Docks must be targeted at the seedling stage to achieve effective control The optimum time to spray docks is late spring due to the rapid growth period before flowering There is a range of herbicides available for controlling docks, some of which are clover-safe Spot spraying may be an effective way of controlling docks early on without checking development of the new sward
Redshank	Typically found in damp, acidic soils, its rapid germination in spring and early summer will smother grass seedlings	Best treated at the rosette stage Effective herbicides include 2,4D or dicamba
Thistles, nettles and buttercups	Although less common in new leys, these weeds can still hinder sward productivity Thistles can be spread by wind-blown seed or underground roots	Cut plants early to prevent seeding Effective herbicides include 2,4D, clopyralid, fluroxypyr and triclopyr Deep cultivations when reseeding
Ragwort	Ragwort is highly toxic to stock and humans Spread by windborne seed. It is a biennial plant with leaf development in the first year and flowering in the second	Graze new leys tightly without poaching or harrow lightly in spring. Young ragwort does not tolerate disturbance Avoid cutting Effective herbicides include 2,4D/MCPA Pulling light infestations is an option but always wear gloves and protective clothing

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