

The Home-Grown Forages Directory



The information in this booklet has been compiled by EBLEX Livestock Scientists Dr Mary Vickers and Dr Liz Genever, with guidance from independent consultants David Hendy and Charlie Morgan.

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For more information contact:

**Better Returns Programme
EBLEX
Stoneleigh Park
Kenilworth
Warwickshire
CV8 2TL**

**Tel: 0870 241 8829
Email: brp@eblex.ahdb.org.uk
www.eblex.org.uk**

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Any enquiries regarding this document should be sent to: EBLEX Division, AHDB, Stoneleigh Park, Kenilworth, Warwickshire CV8 2TL



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Feed represents a major cost to beef and lamb producers and its quality is a major determinant of animal performance.

Home-grown forages offer the opportunity to reduce reliance on bought-in feeds, provide a valuable break crop between pasture re-seeds, improve soil structure and in some cases provide a source of home-grown straw.

There are several crops to consider from grass and clover to cereals, pulses and brassicas. The choice of which crops to grow will depend not only on the

type of livestock the farm carries and the production system, but also the land and soil type.

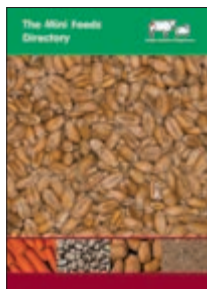
Use this directory to compare different crops in terms of nutritional value, agronomic performance and the practicalities of growing and feeding them.

Choose your crops carefully, grow and feed them well, then reap the benefits for your livestock, land and business.

Dr Mary Vickers
EBLEX Livestock Scientist



This directory considers the options for growing forages on sheep and beef farms to help reduce reliance on purchased feeds.



It can be used alongside the BRP Mini Feeds Directory which contains information about home-grown feeds such as grains and roots, as well as purchased feed options like co-products such as brewers' grains and bread.

Crop choice

The main considerations for farmers choosing which forage to grow are:

- Nutritional quality in relation to type of livestock to be fed
- Yield and cost of production
- Agronomic issues such as how the crop will fit into the farm's rotation and suit the land available

The main factor determining the cost of growing a crop (£/tonne) is yield, so every effort should be made to grow as high a yield as possible, and then to harvest and feed it efficiently.

Many people underestimate the amount of wastage between the field and the trough. Attention to detail at harvest, storage and feed-out will minimise these losses, and maximise the percentage of grown crop actually eaten.

Other potential benefits of growing home-grown feeds are:

- Provides a supply of home-grown straw
- Good break crop between grass re-seeds
- More efficient use of slurry and manures
- Reduced exposure to volatile feed commodity markets
- A source of cost effective energy and protein

Livestock farmers who do not have land available to grow forage crops, or who do not have the skills or machinery to do so successfully, can turn to contractors to manage the process. Alternatively they can buy standing or harvested crops, or contract neighbouring farmers to grow crops for them.

Sources of further information

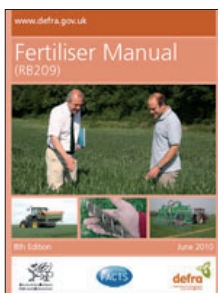
When considering what crop to grow, always seek advice from a suitably qualified agronomist. Choose the most appropriate varieties for your farm and farming system. Key characteristics such as yield potential and disease resistance vary considerably between varieties.

Independent guidance can be found at:

The Recommended Grass and Clover Lists on the EBLEX website, for the latest grass and clover varieties.

HGCA for cereals and oilseed rape, visit: www.hgca.com and click on the Varieties tab.

Guidance of fertiliser requirements for different crops can be found in the Fertiliser Manual (RB209) available at www.gov.uk. Search: Fertiliser Manual.



Key to tables

FW: fresh weight	CP: crude protein
DM: dry matter	N: nitrogen
ME: metabolisable energy	P: phosphate
	K: potash



Grazed grass

Grazed grass is potentially the cheapest source of forage on farm. But to get the best out of it, regard it as a crop and grow with an 'arable mentality'; then feed and utilise in a way that minimises waste.

Not all pasture is the same. Recently re-seeded leys with high clover content can deliver better animal performance than grass that has less nitrogen input or old permanent pasture.

	Grazed grass	Grass with high white clover percentage	Grass with low nitrogen input	Poor quality sward
Nutritional notes	Grazed grass quality will vary throughout the season and according to management. The amount of clover in the sward affects nutritional quality. Increasing clover content increases crude protein levels and digestibility. If the percentage of weed grasses such as annual meadow grass is high, feed quality is likely to be low.			
Management options	The two main types of grazing strategies are set stocking and rotational grazing. Strip grazing is another option where an electric fence is moved regularly to control access to pasture. Close management of sward height, when the animals enter and leave a field, is vital to optimise sward utilisation and quality.			
Target FW yield	65t/ha (26t/ac)	65t/ha (26t/ac)	57t/ha (23t/ac)	40t/ha (16t/ac)
Target DM yield	11.1t/ha (4.49t/ac)	10.4t/ha (4.21t/ac)	10.3t/ha (4.17t/ac)	7.2t/ha (2.91t/ac)
Utilisation %*	65	65	65	55
DM %	17	16	17	18
ME MJ/kg DM	11.5	12.0	11.5	10.5
CP % in DM	17	19	18	15
Starch % in DM	-	-	-	-
Sowing time	Spring or early autumn			
Persistency	Depends on the objective of the pasture, over eight years is possible with good management			
Agronomic notes	Choose grass varieties to suit grazing requirements. Check pH, P and K indices. Low white clover levels will mean that N fertiliser, FYM or slurry will be needed to ensure yield is maintained.	Choose clover varieties to suit grazing requirements. Will reduce N fertiliser requirement. Check pH, P and K indices. Weed control can be difficult as clover can be killed too. Maybe use a weed wiper.	Low nitrogen levels may increase clover levels, but check pH, P and K indices to ensure on target for clover, and adjust if possible. May attract agri-environmental scheme payments.	Check pH, P and K indices, as off target results may be causing the poor quality sward. Weed control is crucial. May attract agri-environmental scheme payments.

* Levels achievable under good grazing systems. In many cases utilisation may be less than 50%.



Conserved grass

Grass silage can provide high feed value forage. Silage quality is directly related to the quality of the grass used to make it. However, there is always a compromise between quality and yield.

Hay is a high risk option as it requires dry conditions and is lower quality than silage, but it is cheaper to produce.

The optimum cutting date should be influenced by the class of stock the silage will be fed to, eg dry suckler cows or finishing cattle.

	1 st cut grass silage	1 st cut grass silage (late cut)	2 nd cut grass silage	Hay
Nutritional notes	Feed quality is very variable and depends on the growth stage of the crop at harvest. Intake by livestock depends on many factors, but the main ones include DM content and fermentation characteristics.			
Harvest and conservation options	The choice of storing silage as big bales or in a clamp will depend on the availability of clamp space and contractors and/or equipment, the amount of silage being made and the intended feeding system.			
Target FW yield [round bales]	23t/ha (9.3t/ac) [16.3t/ha (6.6t/ac)]	25t/ha (10t/ac) [19t/ha (7.7t/ac)]	13t/ha (5t/ac) [11t/ha (4.5t/ac)]	6t/ha (2.5t/ac) –
Target DM yield	5.7t/ha (2.3t/ac)	6.8t/ha (2.8t/ac)	3.8t/ha (1.5t/ac)	5t/ha (2t/ac)
Utilisation %	87	87	87	85
DM % [round bales]	25 [35]	27 [35]	30–45 [35]	85
ME MJ/kg DM	11.2	10.8	11.0	8.5–9.5
CP % in DM	15	13	14	9
Cutting time	May	June	June–July	July–Sept
Persistency	Three to eight years if managed well			
Agronomic notes	<p>Choose grass and clover varieties to suit requirements.</p> <p>Check pH, P and K indices.</p> <p>Make best use of FYM or slurry – check Defra publication the Fertiliser Manual (RB209) for recommendations.</p> <p>Apply slurry at least six weeks before harvest.</p> <p>Think about weed control.</p>			



Perennial and Italian Ryegrass (IRG) for silage

Silage can be cut from a variety of field types, from specialist short-term leys to permanent pastures that are mainly grazed.

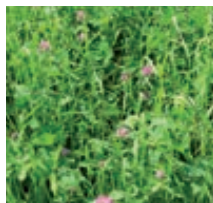
Ryegrasses have been bred for many decades for yield, quality and the ability to use nutrients. They are important for silage making.

	Specialist silage leys (1-3 years)	Medium term cutting and grazing leys (2-4 years)	Long term cutting and grazing leys (5+ years)
Perennial ryegrass (diploid)	✗	✓	✓
Perennial ryegrass (tetraploid ^a)	✓	✓	✗
Italian ryegrass	✓	✗	✗
Hybrid ^b ryegrass	✓	✓	✗

^a Tetraploids have a more upright growth habit and work better in a cutting system than diploids.

^b Hybrid ryegrasses are a cross between perennial and Italian varieties, combining the strengths of the two parent species.

	Italian Ryegrass	Italian Ryegrass with red clover
Nutritional notes	IRG is quick to establish and grows rapidly, and is excellent for cutting. High yields are possible although digestibility is slightly lower than perennial ryegrass varieties. Adding red clover to the mixture will increase the protein content of the silage. Grazing the aftermath is possible as modern red clover varieties tend to cause less bloat. Caution: do not graze with ewes six weeks before to six weeks after tupping.	
Harvest and conservation options	IRG is usually ready for cutting before perennial ryegrass and should be harvested before the main perennial crop. Waiting until the perennial ryegrass has matured, will sacrifice quality of the IRG as it will over-mature. The choice of storing silage as big bales or in a clamp will depend on the availability of clamp space and contractors and/or equipment, the amount of silage being made and the intended feeding system.	
Target FW yield	52t/ha (21t/ac)	49t/ha (20t/ac)
Target DM yield	14t/ha (5.7t/ac)	13t/ha (5.3t/ac)
Utilisation %	87	87
DM %	27	27
ME MJ/kg DM	11	10.8
CP % in DM	13	17
Sowing time	Mar-Apr or Aug-Oct	Mar-May or Aug-Oct
Cutting time	Apr-May, Jun-Jul and Aug-Sept	Apr-May, Jun-Jul and Aug-Sept
Persistency	Up to three years	Up to three years
Agronomic notes	Check pH, P and K indices.	Check pH, P and K indices. Adding red clover to the mix will reduce the nitrogen fertiliser requirement. Leave five years before red clover is grown again in the same field.



Clover for silage

White and red clover can make excellent conserved forage, but selecting the right type is essential.

	Specialist silage leys (1-3 years)	Medium term cutting and grazing leys (2-4 years)	Long term cutting and grazing leys (5+ years)
White clover (small leaf)	✗	✓	✓
White clover (medium leaf)	✓	✓	✓
White clover (large leaf)	✓	✓	✗
Red clover	✓	✓	✗

White clover:

Clover is best established after a crop that has reduced the nitrogen content of the soil such as cereals or brassicas. Broadcasting is a good method of establishment as it does not bury the seed as deeply as drilling. Alternatively clover can be undersown with a cereal crop which is then harvested early for wholecrop. Often grown in a mixture with companion ryegrasses. It can also be introduced to an existing sward. Sowing time April to August.



Red clover:

Red clover is shorter lived than white clover and more suitable for cutting than grazing due to the risk of damage to the crown from trampling. However varieties more tolerant to grazing are now available. Red clover is usually grown in a mixed sward with grass, but is also grown as a monoculture. It can be drilled or broadcast, or undersown to an arable silage crop in April. It can also be introduced to an existing sward.

Further reading

For best practice advice on clover or for silage making request a copy of BRP Beef and Sheep Manual 4: **Managing Clover for Better Returns** and/or Manual 5: **Making Grass Silage for Better Returns** by emailing brp@eblex.ahdb.org.uk or calling **0870 241 8829** or download a copy from www.eblex.org.uk.





Chicory

A high quality forage, chicory provides essential minerals to grazing livestock. Improved varieties lasting up to five years are now available.

With a deep taproot, chicory will grow in drier conditions and is very productive.

	Perennial and hybrid ryegrass, white clover and 15% chicory [^]	Red and white clover, and 40% chicory [^]
Nutritional notes	Mixture for more flexible grazing. High levels of protein and minerals, with reasonable DM due to grasses.	Mixture for lamb or cattle finishing. High levels of protein and minerals, but low DM, especially in wetter times.
Harvest and conservation options	Ideally managed by grazing, although a 1 st cut is possible. Light winter grazing is possible as grasses will offer some protection.	Manage by rotational grazing between April and September. Pre-graze height of 15cm to post-graze height of 5cm. Winter grazing should be avoided.
Target FW yield	67t/ha (27t/ac)	83t/ha (33t/ac)
Target DM yield	10t/ha (4t/ac)	10t/ha (4t/ac)
Utilisation %*	65	70
DM %	15	12
ME MJ/kg DM	11	12
CP % in DM	18	20
Sowing time	Mar-Apr or Aug	
Persistence	Up to five years	
Agronomic notes	<p>Check pH, P and K indices.</p> <p>Chicory grows when soil temperature is 10°C or above.</p> <p>Chicory is not a legume, so does not fix nitrogen and will benefit from nitrogen fertiliser applications. The addition of clover will reduce nitrogen requirement.</p> <p>There are no chicory-safe herbicide sprays.</p> <p>Chicory is prone to bolting if not grazed hard during the summer.</p>	

[^] Refers to percentage in seed rate.

* Levels achievable under good grazing systems. In many cases utilisation may be less than 50%.

Further reading

For best practice advice on growing and feeding forage chicory see EBLEX BRP+ **Using Chicory and Plantain in Beef and Sheep Systems**. Download a copy from www.eblex.org.uk.



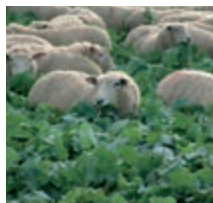


Kale (grazed)

Kale is a late summer catch crop which can provide high yields of succulent green fodder. It can be a low cost option for finishing lambs, or used for beef cattle towards the end of the grazing season.

Nutritional notes	Always introduce stock slowly to this crop over a week to ten days and with a full stomach. Provide a grass run-back area and hay, silage or straw (fibre) in the field as it is being grazed. Minerals and water should also be available. Limit crop to 50-80% of total DM intake. Good mineral supplementation is essential, especially for dry cows as the crop is high in calcium and low in magnesium and phosphorus. Attention should also be given to iodine and selenium levels.
Harvest and conservation options	The crop is best strip grazed to avoid excessive wastage and ensure both leaf and stem are eaten. A good winter feed.
Target FW yield	60-70t/ha (24-30t/ac)
Target DM yield	8-9t/ha (3-4t/ac)
Utilisation %	80+
DM %	15-17
ME MJ/kg DM	10-11
CP % in DM	14-17
Sugars % in DM	17
Sowing time	May-Jun
Persistence	Annual
Agronomic notes	<p>Sow six months before being utilised. Prepare a fine, firm, clean seed bed. Can be sown by broadcasting, drilling or direct drilling. Direct drilling can be successful as it improves soil moisture retention and produces a firmer surface that is less prone to poaching, compared to land that has been ploughed.</p> <p>Choose varieties that will suit the desired grazing season and resistant to diseases such as clubroot. Seed dressing to protect against flea beetle is recommended.</p> <p>Avoid choosing sites with heavy soils or steep slopes where poaching and water/soil run-off may be a problem. Ensure pH levels of 5.8 to 6 and P and K indices of 2.</p> <p>A gap of four to five years (in drier areas of the UK) or seven to eight years (in wetter areas) between crops is advised to reduce disease risk.</p>
Kaleage	Kale can be mown and baled or ensiled with wholecrop cereal (50/50) as it can be too wet to ensile on its own. It can be harvested 12 weeks after drilling. Stems should be no more than finger thickness at harvest and cut with a mower conditioner/crimper to help dry it out. A 48 hour wilt is ideal and the crop needs to be wrapped well. Analysis 20-25% DM. 11-12 MJ ME/kg DM. 16-18% CP.

See Brassica Health Warning on page 12.



Forage rape

Forage rape is a fast growing leafy catch crop with a high protein content. It tends to last longer than stubble turnips. Winter-hardy hybrids are available. It has a flexible sowing period and is good for fattening lambs. It can also be used to feed dairy and beef cattle.

Nutritional notes	Always introduce stock slowly to this crop over a week to ten days and with a full stomach. Provide a grass run-back area and hay, silage or straw (fibre) in the field as it is being grazed. Minerals and water should also be available. Limit crop to 50-80% of total DM intake. Good mineral supplementation is essential, especially for dry cows as the crop is high in calcium and low in magnesium and phosphorus. Attention should also be given to iodine and selenium levels.
Harvest and conservation options	The crop is best strip grazed to avoid excessive wastage with cattle, but sheep can be blocked grazed. Provides summer or autumn feed.
Target FW yield	30-50t/ha (12-20t/ac)
Target DM yield	4-5t/ha (1.6-2t/ac)
Utilisation %	80+
DM %	10-12
ME MJ/kg DM	10-11
CP % in DM	19-20
Sowing time	End April to Mid August – depending on area
Persistence	Annual
Agronomic notes	Sow three months before being utilised. Prepare a fine, firm, clean seed bed. Can be sown by broadcasting, drilling or direct drilling. Direct drilling can be successful as it improves soil moisture retention and produces a firmer surface that is less prone to poaching, compared to land that has been ploughed. Choose varieties that will suit the desired grazing season and resistant to diseases such as clubroot. Seed dressing to protect against flea beetle is also recommended. Avoid choosing sites with heavy soils or steep slopes where poaching and water/soil run-off may be a problem. Ensure pH levels of 5.8 to 6 and P and K indices of 2. A gap of four to five years (in drier areas of the UK) or seven to eight years (in wetter areas) between crops is advised to reduce disease risk.

Newly developed 'Hybrid brassicas' have been bred with more vigorous growth, winter hardiness and better potential re-growth (if not overgrazed initially), with high DM yields – 6-7t DM/ha, and up to 2t DM/ha as a re-growth.

Brassica mixtures, including combinations of hybrids, forage rape, kale, stubble turnips, are also becoming popular focusing on specific combinations to achieve high DM yields and daily intake, and to supplement specific grazing situations.

Discuss with your seed supplier options that would benefit your own system.

See Brassica Health Warning on page 12.



Forage roots



Turnips (summer/grazing or stubble)

Turnips are fast growing and make good autumn or winter feed. Good for finishing lambs or feeding cattle when grass growth slows. Economical to grow, turnips can help reduce winter feed costs.

Nutritional notes	Always introduce stock slowly to this crop over a week to ten days. Provide a grass run-back area and hay, silage or straw (long fibre) in the field as it is being grazed. Minerals and water should also be available. Limit crop to 50-80% of total DM intake.
Harvest and conservation options	The crop is best strip grazed to avoid excessive wastage and ensure leaf and bulbs are consumed. Provides late summer, autumn and early winter feed.
Target FW yield	30-50t/ha (12-20t/ac)
Target DM yield	5-6t/ha (2-2.4t/ac)
Utilisation %	75-85
DM %	10-15
ME MJ/kg DM	10-11
CP % in DM	17-18
Sugars % in DM	55
Sowing time	End April to Mid August – depending on area
Persistence	Annual
Agronomic notes	Sow eight to 14 weeks before being utilised. Can be sown by broadcasting, drilling or direct drilling. Direct drilling improves soil moisture retention and produces a firmer surface that is less prone to poaching, compared to land that has been ploughed. Choose varieties that will suit the desired grazing season and resistant to diseases such as clubroot. Seed dressing to protect against flea beetle is also recommended. Avoid choosing sites with heavy soils or steep slopes where poaching and soil/water run-off may be a problem. A gap of four to five years (in drier areas of the UK) or seven to eight years (in wetter areas) between crops is advised to reduce disease risk.

See Brassica Health Warning on page 12.

Further reading

For best practice advice on brassicas request a copy of BRP Beef and Sheep Manual 6: **Using Brassicas for Better Returns** by emailing brp@eblx.ahdb.org.uk or calling 0870 241 8829 or download a copy from www.eblx.org.uk.



Forage roots



Swedes

Swedes are an excellent high energy winter feed which are cost-effective to grow. Good crop for finishing lambs or for winter maintenance.

Nutritional notes	Swedes can be hard to eat for stock that are changing or losing their teeth. Only recommended for wintering lambs or cattle with fully mature teeth. Not suitable for broken mouthed sheep. If roots are lifted they must be free of soil and not damaged.
Harvest and conservation options	Strip grazing will minimise wastage. Can be lifted and clamped and then fed chopped. Provides winter feed.
Target FW yield	40-60t/ha (16-24t/ac)
Target DM yield	8t/ha (3.2t/ac)
Utilisation %	80+
DM %	9-13
ME MJ/kg DM	12-13
CP % in DM	10-11
Sugars % in DM	59
Sowing time	Apr-May
Persistency	Annual
Agronomic notes	<p>Sow six months before being utilised. Prepare a fine, firm, clean seed bed. Can be sown by broadcasting, drilling or direct drilling. Direct drilling can be successful as it improves soil moisture retention and produces a firmer surface that is less prone to poaching, compared to land that has been ploughed.</p> <p>Choose varieties that will suit the desired grazing season and resistant to diseases such as clubroot. Seed dressing to protect against flea beetle is also recommended.</p> <p>Avoid choosing sites with heavy soils or steep slopes where poaching and soil/water run-off may be a problem.</p> <p>Ensure pH levels of 5.8 to 6 and good P and K indices of 2.</p> <p>A gap of four to five years (in drier areas of the UK) or seven to eight years (in wetter areas) between crops is advised to reduce disease risk.</p>

See Brassica Health Warning on page 12.



Fodder beet

Fodder beet provides a nutritious crop that can provide useful winter forage. It can also be an ideal replacement for cereals.

Nutritional notes	A high energy, palatable crop. May need washing prior to feeding or clamping. Frosted beet that is very black and rotten should not be fed. Potentially a very high yielding crop in terms of megajoules of metabolisable energy/ha.
Harvest and conservation options	Can be grazed in-situ or lifted and fed after cleaning. Can be fed whole or chopped. Utilisation will be lower if grazed. Harvesting late in the season can be difficult on heavy land. Provides winter feed.
Target FW yield	80-90t/ha (32-36.t/ac)
Target DM yield	15t/ha (6t/ac)
Utilisation %	80+
DM %	12-19
ME MJ/kg DM	12-12.5
CP % in DM	6-8
Sugars % in DM	65
Sowing time	April at the latest
Persistence	Annual
Agronomic notes	Must be sown early. Select varieties depending on whether the crop will be fed in-situ or lifted and clamped. Higher DM varieties tend to store better. Requires precision drilling into a good seed bed and good weed control to ensure crop reaches potential. Can be a break crop for brassicas.

Brassica health warning

Brassicas contain high levels of readily digestible carbohydrate but are low in fibre so should always be fed with *ad lib* fibrous forage such as straw, silage or hay, to promote healthy rumen function. Limit crop to 50-80% of total DM intake depending on what type of livestock are being fed and what long fibre is available.

Breeding cows in late pregnancy should not be grazed on brassicas, to avoid the risk of calving in an unsuitable environment. Ewes in late pregnancy fed on root crops will generally need additional protein to ensure their full requirements are met.

Minerals and fresh water should always be available when grazing brassicas. The high calcium content of brassicas can predispose pre-calving cows to hypocalcaemia if they are not fed low calcium forages such as straw or hay at the same time. Brassica root crops tend to have lower protein content than leafy brassica crops.

For more detailed information see BRP Beef and Sheep Manual 6: **Using brassicas for Better Returns**. Request a copy by emailing brp@eblex.ahdb.org.uk or call 0870 241 8829.



Bi-cropping

Choosing the right cereal and legume variety combination is important and will depend on location and soil type. The legume part of the mixture also has the ability to fix atmospheric nitrogen, which provides some nitrogen for the growing crop and a high level of residual nitrogen for the following crop.

The key to successful bi-cropping is weed control, in particular of grass weeds, which can be achieved by the use of herbicides, although the choice is more limited where two different types of crops are being grown together. They can also be controlled by crop rotation. The grain yield of the cereal is positively related to the amount of nitrogen applied to the crop.

As well as crop selection, harvesting and ensiling are important areas to get right when growing and feeding bi-crops.

Clover and cereals

Under-sowing a spring cereal or a hybrid/Italian ryegrass with red clover, can be very successful. Alternatively it is possible to direct drill an autumn sown cereal into an established understory of white clover, although competition from weeds can be a problem. In this system winter wheat is the most compatible cereal, but a reduced seed rate is required compared to a conventional winter wheat crop. Autumn or spring barley and triticale and spring wheat are other options.



Bi-cropping usually combines a spring sown cereal such as wheat, barley, oats or triticale, and a spring sown legume crop like peas or lupins.

The cereal crop provides energy in the form of starch and the legume provides protein. Modern harvesting machinery allows the crops to be harvested when the nutrients are at their optimum.

Cereals and lupins

The most common option here is a lupin-triticale whole crop, which can be under-sown with a ryegrass if required.

Spring cereals and peas or beans

This crop combination provides a useful source of starch and protein and can be grown and harvested using conventional equipment.

It should be forage harvested and ensiled or baled. Vermin-proof stores are important as rats can be a problem. Store bales away from buildings, no more than two abreast, and preferably alongside a farm track for easy access.

For example, suggested seed rates – spring oats 125kg/ha and peas 100kg/ha.

Benefits of bi-cropping:

- Ability to produce a nutritionally-balanced feed
- Simultaneous cropping and fertility building
- Effective nutrient cycling
- Improved soil structure and increased organic matter content
- Increased soil biological activity
- Weeds replaced by clover beneath cover crop reduces need for intensive weed control
- Different crops grown at the same time confuses insect pests and provides a more diverse habitat for beneficial insects, spiders etc



Lucerne

Lucerne is a high protein, leguminous forage crop which is drought tolerant. It can be harvested and stored as clamp or big bale silage or hay.

	Lucerne silage	Lucerne grazed
Nutritional notes	Lucerne is a high protein legume which is usually grown for cutting. Can be grazed but the crop is susceptible to damage by trampling; bloat also can be an issue. Hard or frequent grazing should be avoided, especially during its first year, as the crop will not tolerate it.	
Harvest and conservation options	To achieve a 30% DM silage with optimal yield and quality, harvest the crop at the mid-to-late bud stage, when the flowers are just beginning to develop colour. Avoid heavy grazing or cutting in the first year of establishment. Cut at 7.5cm to promote regrowth. Requires frequent cutting every six weeks from the end of May. Usually four cuts per year.	
Target FW yield	40t/ha (16t/ac)	60-70t/ha (24-28t/ac)
Target DM yield	12t/ha (4.8t/ac)	10-12t/ha (4-5t/ac)
Utilisation %	87	80+
DM %	30	12-18
ME MJ/kg DM	10	10
CP % in DM	17-22	18-20
Sowing time	Apr-May, Jul-Aug	
Persistence	Four to five years	
Agronomic notes	<p>Lucerne is deep rooted and particularly drought tolerant making it a valuable crop in dry summers. It also provides a nitrogen reserve for the following crop. Inoculation of the seed prior to sowing is recommended to ensure successful root nodulation and nitrogen fixation.</p> <p>Lucerne can be relatively slow to establish. For this reason many farmers undersow lucerne with a spring cereal crop. Priority should be given to the lucerne by reducing the sowing rate of the cereal by one third and cutting as arable silage or wholecrop.</p> <p>Lucerne can also be sown in the summer following an early-harvested cereal such as winter barley. The middle of August is the latest date for sowing, provided a good seedbed can be made and there is sufficient moisture.</p> <p>As a legume crop it does not need nitrogen applications, but will benefit from P and K applications to maintain soil indices.</p> <p>Lucerne is not very competitive and will not tolerate weeds.</p> <p>Crop should not be grown again on the same site for five years to reduce disease risk.</p>	

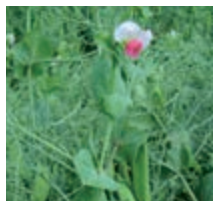
For more information see **BRP+ Growing and Feeding Lucerne for Better Returns** at www.eblex.org.uk.



Lupins

Lupins are a leguminous crop that can be fed as wholecrop or as grain. There are distinct differences between lupin species in terms of their feeding values.

	Lupin and cereal wholecrop	White lupins (grain)	Yellow lupins (grain)	Blue lupins (grain)
Nutritional notes	Lupins are relatively high in protein and high in digestible undegradable protein. However, composition of the crop will vary considerably due to the type of lupins being grown. Lupin grains have a relatively high oil content of 4-10%.			
Harvest and conservation options	The seed can be harvested dry or crimped at 30-40% moisture or the whole plant ensiled at 20-30% moisture. Applying a desiccant pre-harvest will ease combining for grain harvest. Wholecrop for ensiling should be harvested when flowering is complete and all the seeds are fully formed in the pods but still green. The wholecrop can be baled or clamped.			
Target FW yield	34t/ha (13.8t/ac)	11t/ha (4.5t/ac)	11t/ha (4.5t/ac)	11t/ha (4.5t/ac)
Target DM yield	10t/ha (4t/ac)	8t/ha (3.2t/ac)	8t/ha (3.2t/ac)	8t/ha (3.2t/ac)
Utilisation %	85	87	87	87
DM %	30	70-85	70-85	70-85
ME MJ/kg DM	10.5-11	15	13	13.5
CP % in DM	15-20	36-40	36-42	31-35
Sowing time	Mar-Apr			
Persistency	Annual			
Agronomic notes	Inoculation of the seed prior to sowing is recommended to ensure successful root nodulation and nitrogen fixation. As a legume crop it does not need nitrogen applications, but will benefit from P and K applications to maintain soil indices. Select varieties suitable to local conditions. Growing as a bi-crop with a cereal is recommended to avoid getting very wet material at harvest which is difficult to ensile.			



Forage peas

Forage peas have very high protein content and are often grown as a bi-crop or under-sown with grass. An excellent break crop.

	Wholecrop peas	Dried peas
Nutritional notes	Forage peas are a quick growing, high protein crop that can produce a highly palatable feed.	
Harvest and conservation options	Can be strip grazed in-situ, ensiled or harvested dry. Ensilage 11-14 weeks post-sowing when the plant is still flowering and pods are formed but peas are only just beginning to develop ('mange tout' stage). Wilting for 24/36 hours is recommended and precision chopping is essential.	
Target FW yield	25t/ha (10t/ac)	5t/ha (2t/ac)
Target DM yield	7.5t/ha (3t/ac)	4.4t/ha (1.8t/ac)
Utilisation %	87	90
DM %	30	86
ME MJ/kg DM	10	12.8
CP % in DM	16	24
Starch % in DM	7	47
Sowing time	March	
Persistency	Annual	
Agronomic notes	<p>Peas will not grow well on compacted soil. They are also susceptible to lodging which can make harvesting difficult.</p> <p>Peas can fix up to 75kg N/ha during the season. As a legume crop it does not need nitrogen applications, but will benefit from P and K applications to maintain soil indices. Often a cereal crop follows peas to capture the residual nitrogen in the soil.</p> <p>Peas and barley can be grown together as arable silage or under-sown with grass.</p> <p>Grow in a five to six year rotation to avoid the soil-borne disease fusarium.</p>	



Field beans

Field beans are mainly grown for their seed which is high in protein. Bean crops are classified into two main groups, winter and spring. Winter beans are higher yielding but of slightly inferior feed quality to spring varieties. Winter beans are exposed to greater disease risks, while spring beans are more likely to suffer from drought.

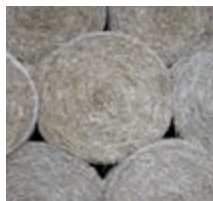
	Wholecrop	Dried beans
Nutritional notes	Most often used as a combinable crop for dry or crimped grain, but can be forage harvested and ensiled or baled when the crop is about 20-25% dry matter.	
Harvest and conservation options	For dried beans, allow the crop to dry out in the field before harvest. Beans can also be harvested moist and crimped. Whole cropping is an option but tends to be less successful than wholecrop peas.	
Target FW yield	25-35t/ha (10-14t/ac)	7.4t/ha (3.0t/ac)
Target DM yield	6.3-8.8t/ha (2.6-3.6t/ac)	6.4t/ha (2.6t/ac)
Utilisation %	85	90
DM %	25	86
ME MJ/kg DM	9.5	13.8
CP % in DM	18	29
Starch % in DM	6	43
Sowing time	Oct-Nov Feb-Mar	
Persistency	Annual	
Agronomic notes	<p>Field beans are a popular break crop. Yield can be variable.</p> <p>As a legume crop it does not need nitrogen applications, but will benefit from P and K applications to maintain soil indices. Often a cereal crop follows beans to capture the residual nitrogen in the soil.</p> <p>Field beans are susceptible to drought so are best grown on heavier soils, less prone to drought. Best grown in a four to five year rotation to reduce disease risk.</p>	



Wheat, barley, oats and triticale

Cereals provide a valuable home-grown source of starch and fibre. As well as the familiar wheat and barley species, oats and triticale are also worth considering because of their better disease resistance which can reduce growing costs.

	Fermented wholecrop	Crimped grain	Dried grain
Nutritional notes	<p>Wholecrop silages can replace all or part of the grass silage in a diet, and can be a good source of fibre and starch.</p> <p>There are various options for harvesting at different stages of maturity and using additives which will affect the yield and nutritional quality of the resulting feed.</p> <p>Some additives, such as those containing urea, can increase the protein content of the silage. Bi-crops containing cereal and legumes will also produce high protein silage.</p> <p>Cereal grains can be harvested moist or dry and are high in energy due to their high starch content. They need processing or treatment if fed to cattle so that they can access all the nutrients.</p>		
Harvest and conservation options	<p>A range of harvesting options is available, including wholecropping and moist grain treatments. Wholecrop can be harvested at various stages of crop maturity. Fit a mill to the forager to crush the grains to avoid poor digestibility in the animal, particularly with higher dry matter crops.</p> <p>If energy density of the feed is more important than providing bulk, increase the height of the stubble to increase the starch content of the silage.</p> <p>Harvesting the grain moist requires the addition of a preservative, but means that the crop can be harvested earlier, before the subsequent crop is drilled.</p>		
Target FW yield	30t/ha (12t/ac)	8-10.5t/ha (3.2-4.3t/ac)	8-10.5t/ha (3.2-4.3t/ac)
Target DM yield	12t/ha (4.9t/ac)	7-9t/ha (2.8-3.6t/ac)	7-9t/ha (2.8-3.6t/ac)
Utilisation %	87	87	90
DM %	30-40	70	86
ME MJ/kg DM	10-11	12.2-13.5	12-13.5
CP % in DM	9	9-14	11-12.1
Starch % in DM	18-22	43-68	43-65
Sowing time	Spring or autumn		
Persistence	Annual		
Agronomic notes	<p>Good yields are required to make wholecrop cereals cost-effective, so crops need as much attention to detail as when they are grown for grain. Barley does not grow well on acid soil, but oats are more acid-tolerant. Triticale requires less fungicide treatments than wheat or barley.</p> <p>Grain protein content can be affected by type, rate and timing of fertiliser applications.</p> <p>Straw quality and quantity can be manipulated by variety, sowing rates and fungicide/ plant growth regulator (PGR) applications.</p> <p>Bi-cropping with legumes or grass are options but can limit weed control methods.</p>		



Straw

Straw is usually low in protein. Ammonia treatment can increase the protein content from 4% to 8-10% CP and improve its digestibility, although it does need specific vitamin and mineral supplementation. Ammonia-treated straw is not always a suitable replacement for untreated straw as it has reduced 'scratch-factor', so always seek nutritional advice before feeding it.

Straw is a valuable source of 'scratch factor' in a ration, as it promotes optimum rumen function, particularly important when large amounts of cereals or starch are being fed in a finishing diet. It is also a useful bulky feed for dry suckler cows to satisfy appetite.

When grain is harvested separately from the straw, the latter can be baled dry or ensiled as strawlage, for example after crimping. Strawlage can be expected to analyse at an ME of 7MJ/kg DM and CP 4.5% in the DM.



Forage rye

Forage rye is a useful crop for early turnout and helps reduce overwintering costs for cattle. It can also be used for winter sheep grazing.

Nutritional notes	Forage rye is a useful winter catch crop to go in after maize or cereals to provide winter keep for sheep, youngstock grazing, or early spring cattle grazing. This can allow an early turnout, reducing overwintering costs. Regrowth can be re-grazed.
Harvest and conservation options	Potentially graze from late February onward, when the crop is 15cm tall. Strip grazing is recommended to minimise waste. Early grazing will increase the likelihood that a second growth flush will occur before the crop is ploughed out. When growth starts in the spring the crop needs to be used quickly before it becomes coarse and unpalatable.
Target FW yield	28t/ha (11.3t/ac)
Target DM yield	5.5t/ha (2.2t/ac)
Utilisation %	80
DM %	20
ME MJ/kg DM	10
CP % in DM	11
Sowing time	Aug-Oct
Persistence	Annual
Agronomic notes	Forage rye should not be allowed to enter the winter too well grown. In such cases a light grazing in late November can encourage tillering and increase spring yield. It is a useful crop after maize as it can be sown later in the year, using up residual nitrogen whilst reducing potential soil erosion.



Forage maize



Forage maize

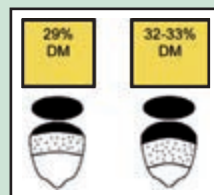
Forage maize provides high energy forage due to its high starch content. Early maturing varieties allow this crop to be grown across England. In some marginal areas there is the option of growing under plastic. A good crop for utilising farmyard manure and slurry.

	Silage	Crimped grain	Ground ear maize
Nutritional notes	Maize silage is a high energy forage, with good levels of starch. It has good intake characteristics and increases overall forage intake when mixed with other silages. Ideal chop length is around 2cm depending on the ration composition. If the whole cob is harvested it is called ground ear maize (GEM). Alternatively just the grain can be harvested dry or moist and then crimped. Maize grain is very high in energy and starch and is ideal for finishing rations.		
Harvest and conservation options	Target DM at harvest for ensiling is 30-35% DM. Maize silage can be susceptible to aerobic spoilage during feeding-out, so an additive to minimise this waste can be useful. Keeping a clean, tight clamp face is also important.		
Target FW yield	42t/ha (17t/ac)	13t/ha (5t/ac)	13t/ha (5t/ac)
Target DM yield	13.5t/ha (5.5t/ac)	9t/ha (4.8t/ac)	9t/ha (4-5t/ac)
Utilisation %	87	90	90
DM %	28-35	65-70	60-65
ME MJ/kg DM	10.8-11.7	13.8-14.2	12.3-12.6
CP % in DM	8-9	9-10.5	8.5-9
Starch % in DM	25-35	65-70	55-60
Sowing time	Spring, as soon as soil temperature reaches 8°C at 8-12cm for 5 days. Apr-May		
Persistence	Annual		
Agronomic notes	Good yields are required to make the crop cost effective. Growing under plastic where crop maturity may be late can bring forward harvest date, allowing the field to be re-sown with an autumn cereal crop/re-seed. It also allows maize to be grown in marginal areas or for crimping the grain where it might be difficult for the crop to reach maturity. Growing under plastic adds considerable cost.		

How to determine DM content of growing maize

Take a cob from the plant and break it in half. Remove a kernel from the cob and run a fingernail along the length of the kernel, starting at the flat/dented end working towards the end that was attached to the cob. Note the point where the solid starch ends and the liquid milk begins. In general when the milkline is one third to half way down, the dry matter is 32-35% and ready to harvest.

The Maize Growers Association (MGA) recommends farmers aim to harvest maize silage with a whole plant dry matter of between 32-35%. As with any new technique it is important to relate it to past experience. With this in mind they advise growers to do a standard microwave dry matter test to check the milkline assessment is right.



For more information see Manual 10: **Growing and Feeding Maize for Better Returns** at www.eblex.org.uk.

Forage Directory Summary Table

This table is provided to allow a quick comparison between the crops described in this manual. However, it is important that agronomic and nutritional considerations are taken into account before making any decisions.

	Target DM yield t/ha	Utilisation %	DM %	ME MJ/kg DM	CP % in DM	Sowing time*	Persistency
Grazed grass	11.1	65	17	11.5	17	Sp/A	>8 yrs if managed well
Grazed grass and white clover	10.4	65	16	12	19	Sp/A	>8 yrs if managed well
Grazed grass, low N input	10.3	65	17	11.5	18	-	Possible permanent pasture
Poor quality sward	7.2	55	18	10.5	15	-	
Hay	5	85	85	8.5-9.5	9	-	
1st cut silage (lower yields for subsequent cuts)	5.7	87	25	11.2	15	Sp/A	3-8 yrs
Italian ryegrass (IRG) – silage	14	87	27	11	13	Sp/A	Up to 3 yrs
IRG and red clover	13	87	27	10.8	17	Sp/A	Up to 3 yrs
Chicory, white clover, perennial ryegrass (PRG)	10	65	15	11	18	Sp/S	Up to 5 yrs
Chicory, red and white clover	10	70	12	12	20	Sp/S	Up to 5 yrs
Kale	8-9	80+	15-17	10-11	14-17	Sp/S	Annual crop
Forage rape	4-5	80+	10-12	10-11	19-20	Sp/S	Annual crop
Turnips	5-6	75-85	10-15	10-11	17-18	Sp/S	Annual crop
Swedes	8	80+	9-13	12-13	10-11	Sp	Annual crop
Fodder beet	15	80+	12-19	12-12.5	6-8	Sp	Annual crop
Lucerne – silage	12	87	30	10	17-22	Sp/S	4-5 yrs
Lucerne – grazed	10-12	80+	12-18	10	18-20	Sp/S	4-5 yrs
Lupins – wholecrop	10	85	30	10.5-11	15-20	Sp	Annual crop
Lupins – grain	8	87	70-85	13-15	31-42	Sp	Annual crop
Forage peas – wholecrop	7.5	87	30	10	16	Sp	Annual crop
Dried peas	4.4	90	86	12.8	24	Sp	Annual crop
Field beans – wholecrop	6-9	85	25	9.5	18	Sp/A	Annual crop
Dried beans	6.4	90	86	13.8	29	Sp/A	Annual crop
Cereals – wholecrop	12	87	30-40	10-11.3	9	Sp/A	Annual crop
Cereals – crimped grain	7-9	87	70	12.2-13.5	9-14	Sp/A	Annual crop
Cereals – dried grain	7-9	90	86	12-13.5	11-12	Sp/A	Annual crop
Forage rye	5.5	80	20	10	11	A	Annual crop
Forage maize	13.5	87	28-35	10.8-11.7	8-9	Sp	Annual crop

* Sowing time – Sp = spring, S = summer, A = autumn.

Other BRP publications available

Beef and Sheep BRP

- Manual 1 – Improving Pasture for Better Returns
- Manual 2 – Improved Costings for Better Returns
- Manual 3 – Improving Soils for Better Returns
- Manual 4 – Managing Clover for Better Returns
- Manual 5 – Making Grass Silage for Better Returns
- Manual 6 – Using Brassicas for Better Returns
- Manual 7 – Managing Nutrients for Better Returns
- Manual 8 – Planning Grazing Strategies for Better Returns
- Manual 9 – Minimising Carcase Losses for Better Returns
- Manual 10 – Growing and Feeding Maize Silage for Better Returns

See the EBLEX website www.eblex.org.uk for the full list of Better Returns Programme publications for beef and sheep producers.

For more information contact:

Better Returns Programme

EBLEX
Stoneleigh Park
Kenilworth
Warwickshire
CV8 2TL

Tel: 0870 241 8829
Email: brp@eblex.ahdb.org.uk
www.eblex.org.uk

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