AHDB Agriculture & Horticulture DEVELOPMENT BOARD

Kingshay

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FORAGE CHOICE, COSTS & ROTATIONS REPORT 2010

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Authors: Dr Martin Yeates and Richard Simpson

Kingshay, Bridge Farm, West Bradley, Glastonbury, Somerset BA6 8LU
Telephone (01458) 851555 Fax (01458) 851444
Email: contact.us@kingshay.co.uk Website: www.kingshay.com

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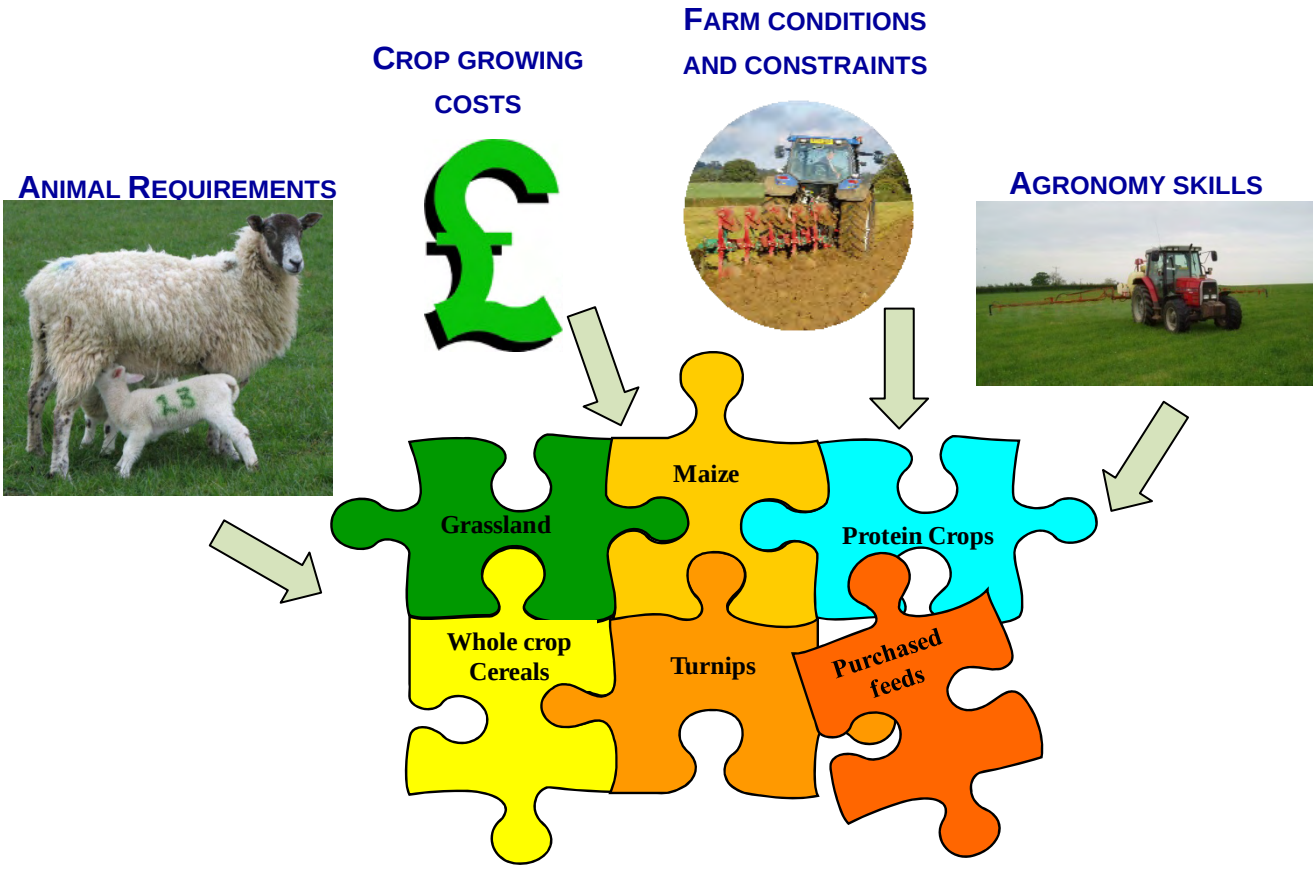
SUMMARY

Whilst feed costs are only part of the input into meat and milk production they are a significant cost, typically making up 40% of the costs of producing a kilo of live weight gain. These average figures hide a huge variation in costs between farms.

Part of this difference between farms is down to selecting the correct mix of forages to best suit each farm and growing each crop to achieve high yields of quality feed.

This report helps that decision making process by focussing on the key aspects of crop agronomy as well as the typical cost of growing each crop. Although cost is only part of the jigsaw of interlocking factors which need to be accounted for when deciding which crops to grow (see diagram), it is often difficult to make genuine cost comparisons on a like for like basis.



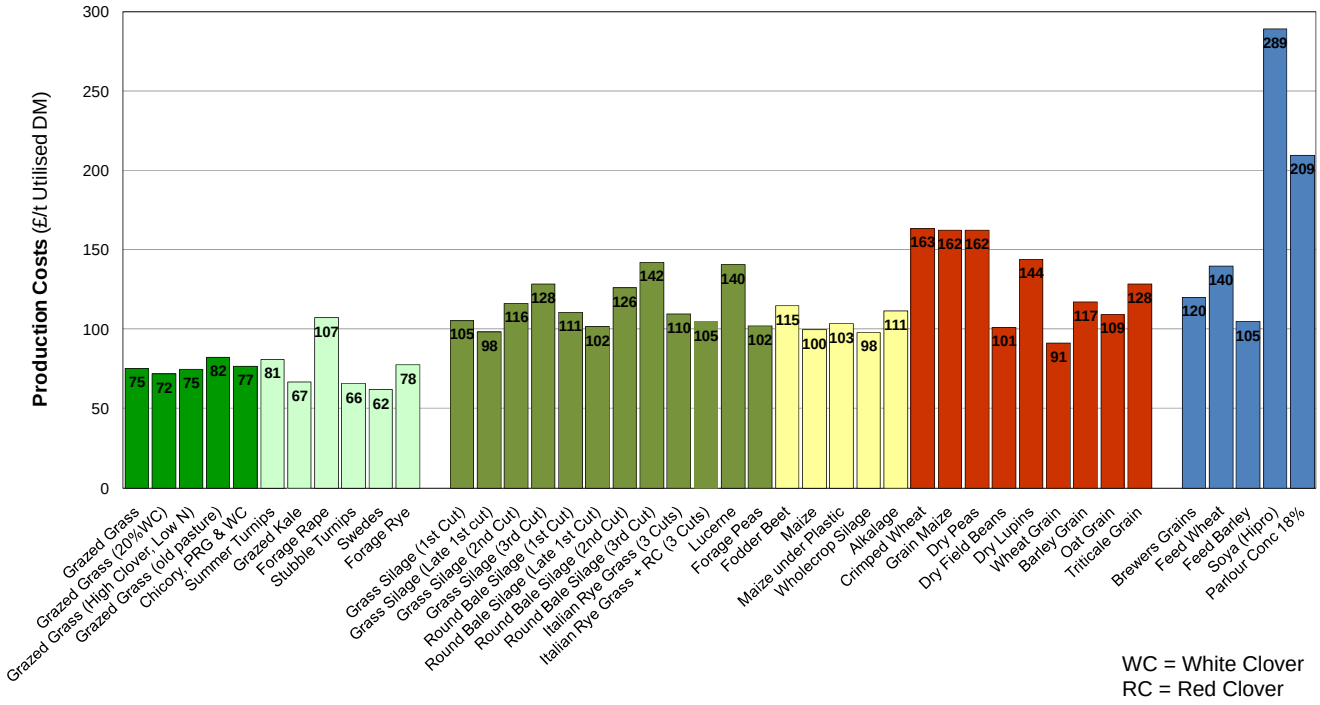
This Report gives a typical cost for growing a tonne of dry matter for a wide range of crops. These costs can then be compared between forages and also against bought in feeds so that a well informed judgement can be made on which crops to grow.

Careful consideration of all these factors will enable the correct range of forages to be grown and costs to be minimised.

SUMMARY

The graph below shows how the production costs of a range of feeds vary on a cost per tonne of dry matter basis. These are compared to the cost of a range of bought in concentrates, highlighting the value of home grown forages.

PRODUCTION COSTS (£/T UTILISED DM) **OF FORAGES AGAINST BOUGHT IN CONCENTRATES**



It can be seen that:

- Grazed forages are cheapest
- Summer Turnips and Kale are the best value summer buffers
- Stubble turnips and Swedes are good value winter grazed forages
- Conserved forages can be good value, especially where yields are high
- High yields are essential to making cereal feeds worth growing

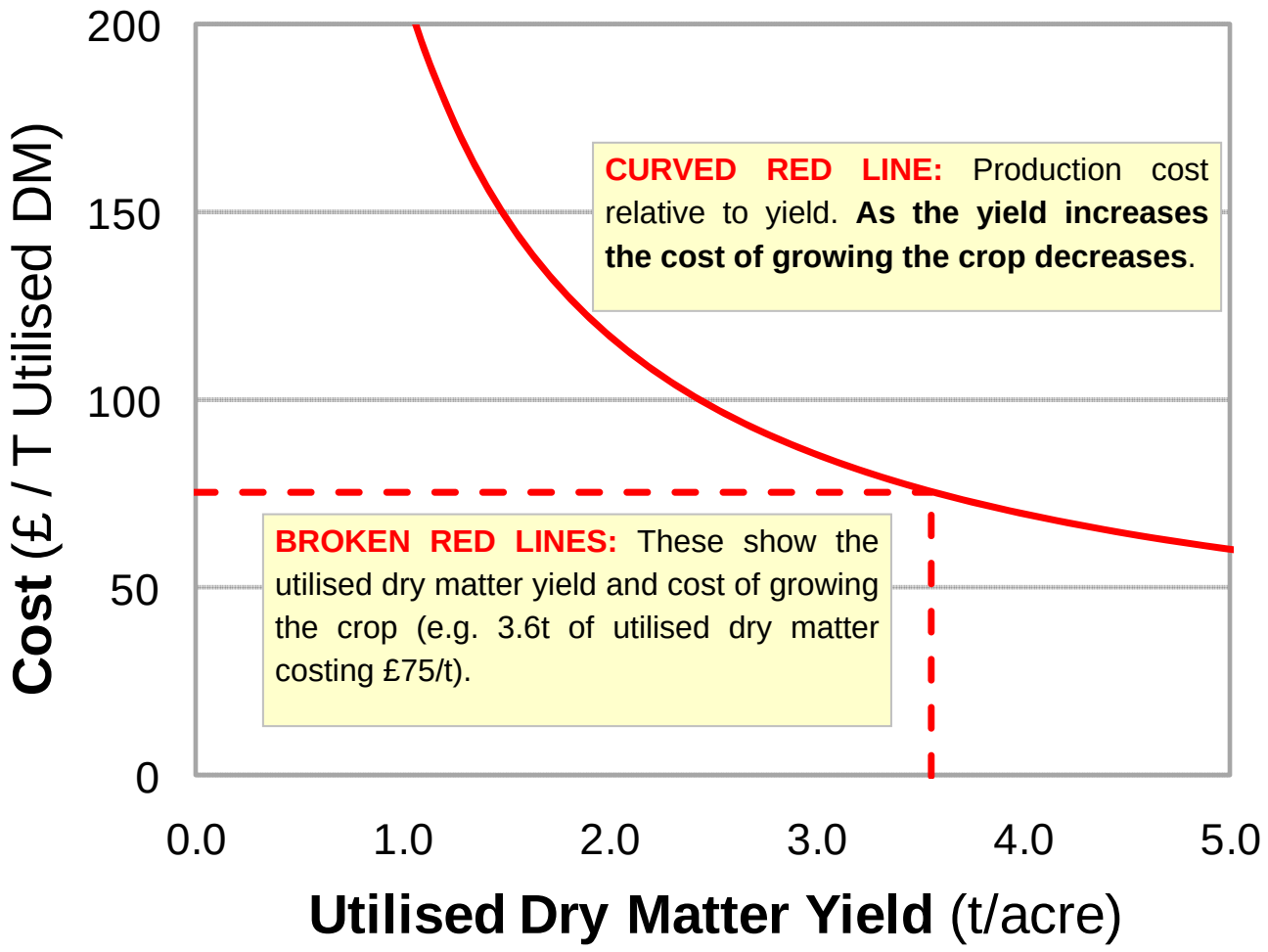
USING THE REPORT

Each crop has a double page of information. The first page (see below) gives practical information on establishing, growing, harvesting and storing the crop.

The second page reports the forage costings. Typical yield, forage quality and costs associated with growing the crop are given. The value of the crop is shown.

The graph shows the impact of growing a better or poorer yielding crop on the cost per tonne of dry matter. As yields decrease the production cost per tonne of dry matter increases.

Production Costs Relative to Crop Yield



ASSUMPTIONS USED IN THE COST CALCULATIONS

1. The costs assigned to each operation or product is based on a wide variety of sources to ensure accuracy, including:
   a. Farm accounts and genuine costs
   b. Contractors charges
   c. Farming merchants and product manufacturers
   d. The Agricultural Budgeting and Costing book
   e. The Farm Management Pocketbook

2. Crops are grown well using appropriate sprays and fertilisers to give good yields.

3. Machinery costs are charged at a contractor rate for jobs such as forage harvesting and at a 50:50 farmer and contractor rate for jobs which could be done by either.

4. A rental equivalent of £90 per acre (£222/ha) is assumed.

5. Establishment costs are spread over the number of years that the crop is in the ground, e.g. the establishment costs of a grazed grass sward are split over the 5 years that the crop will last.

6. If a crop does not use the ground for the whole year, e.g. 2nd cut silage or stubble turnips, then the establishment costs are further reduced to account for this. Rent costs are also assigned proportionately.

7. The proportional assigning of cost depending on the length of time the crop uses the ground is linked to the productivity of the ground in any given month, i.e. summer months are more productive than winter months so a higher proportion of the rent is assigned against summer months than winter months.

8. Storage costs, e.g. depreciation on silage clamps, are assigned to clamped forages, as are sheeting materials and time.

9. All costs are worked out on a utilised dry mater basis so that losses, e.g. field losses for grazed forages and clamp losses for ensiled forages are accounted for. These are stated.

10. All costs are either fixed, e.g. rent, or variable, e.g. fertiliser, in relation to yield. This allows the effect of better or poorer yields to be calculated and graphed accurately. This ensures the cost of a tonne of dry matter with a yield of 1 tonne DM/ac is not twice that of the same crop yielding 2 tonne DM/ac, and results in the curved responses seen on the crop graphs.

GRAZED GRASS

Grazed grass is the cheapest source of forage on farm. To get the best out of grass it needs to be managed with an 'arable mentality', feeding it properly and utilising it in a way that minimises waste. Rotational paddock grazing systems are ideal for maximum control of grazing. Careful monitoring of grass in each paddock or field each week will ensure that the grass is used when it is most nutritious and waste is minimised. Set stocking may require less effort, but it is much more difficult to ensure stock have sufficient high quality grass.

Establishment	
Soil pH	Soil acidity has a huge effect on grass production. Aim for a pH of 6.0 - 6.5. Apply lime at a rate of 2.4 t/ha (1t/ac) per year until the problem is resolved.
Sowing	Cultivate to achieve a fine, firm seedbed or direct drill into an existing sward in Spring or Autumn. Roll to ensure good seed to soil contact.
Seed selection	Select good quality varieties that are palatable, with heading dates that suit your farm.
Fertiliser	Check P & K status and adjust accordingly. 50-75 kg/ha (40-60 units/ac) N may be incorporated into the seedbed. Be aware of NVZ limitations on spreading muck and fertiliser in the Autumn/Winter.
Pests	Act promptly at the first sign of slug damage.

Growing	
Fertiliser Refer to DEFRA's RB209 for more details	Use FYM, slurry and dirty water wherever possible to reduce bagged fertiliser inputs. Ideally slurry and dirty water should be injected or applied below the grass canopy with a trailing shoe to minimise the time until stock can graze the sward again. Fertiliser requirements will vary widely. Typical fertiliser usage rates have declined in recent years to an early N dressing of around 40-50 kg/ha (32-40 units/ac), repeated before turn out. Similar rates will be applied through the season, less if it is dry. P and K needs to be balanced according to soil analyses.
Weeds	Chickweed, docks, thistles and buttercups can all decrease grass yields. Ideally, top pastures to synchronise weed growth and spray at the optimum weed growth stage, using a translocated herbicide. Organically, ensure weeds are topped prior to setting seed and be very aware of bringing in weeds seeds with muck. Thorough composting of FYM can reduce viable weed seed populations.
Pests	Look out for leather jacket damage and spray if necessary

Grazing	
First year	Reseeds will typically be ready for grazing 10 weeks after sowing. Autumn reseeds benefit from a sheep grazing over winter.
General	Rotational Grazing: Monitoring grass growth is essential for cost effective grazing. Put beef animals into swards with a cover of 2,500 – 3,000kg grass DM/ha and graze it down to 1,600kg DM/ha. Sheep should graze swards with a cover of 2,000kg DM, reducing this to 1,400 kg DM before leaving the paddock. Lax grazing will increase intakes in the short-term but lead to low grass quality from mid season. Set stocking: It is still important to proactively manage grazing. Stocking at levels to maintain target sward heights in the spring and summer of 4-6 cm (1½ - 2½") for ewes and lambs and 7-9 cm (3 - 3½") for beef stock will give optimum performance.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		Sow						Sow			
Graze											

Typical Yield and Quality

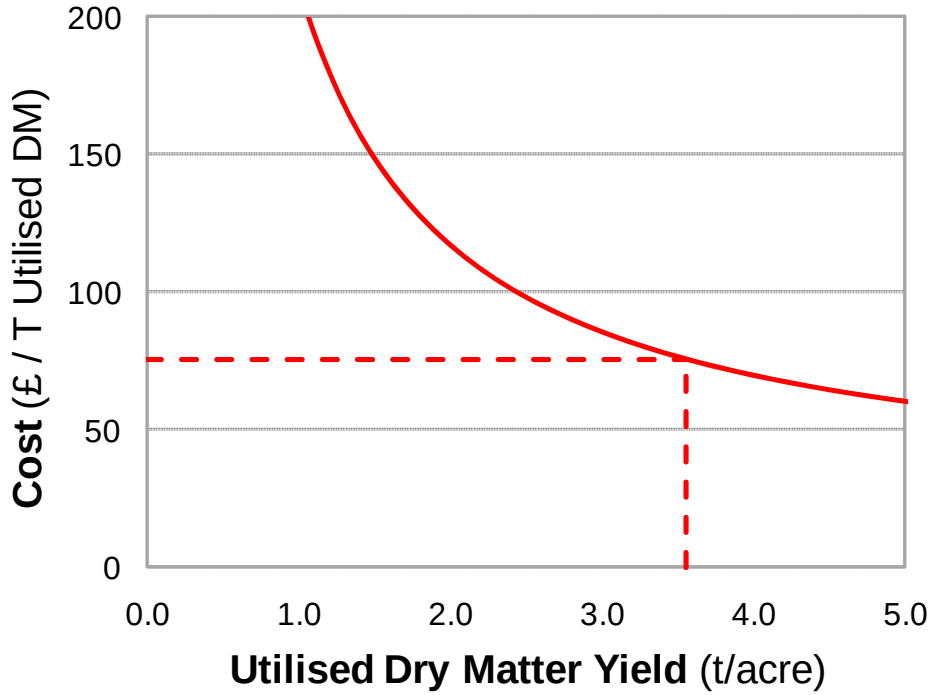
Fresh Yield	65 t/ha (26 t/ac)
Dry Matter	17%
Dry Matter Yield	11 t/ha (4.5 t/ac)
Percentage of dry matter that is utilised	80%
Utilised Dry Matter Yield	8.8 t/ha (3.6 t/ac)
Energy	11.5 MJ/KG DM
Crude Protein	17% in DM

Typical Cost & Value (5 year ley)

	Total Costs	Cash Costs[1]
Cost per Hectare	£663	£443
Cost per tonne fresh weight	£10	£7
Cost per tonne utilised dry matter	£75	£50
Cost per MJ of metabolisable energy	0.7p	0.4p
Cost per 100g of Crude Protein	4.4p	3.0p

[1]Establishment, variable and machinery costs, excluding rent and clamp depreciation

PRODUCTION COSTS RELATIVE TO CROP YIELD



Solid red line:
Production cost depending on yield

Broken red line:
Yield and production costs for the example given in the tables above

Grazed grass can be a high quality, low cost forage especially when it is well grown

Grazed Grass with High White Clover Content

Grazing swards containing clover can offer the very cheapest home grown forage. White clover in the sward will reduce the requirement for bagged N and muck applications, although the sward is still tolerant of moderate levels of Nitrogen to boost grass growth. Clover is highly palatable and contains a good mineral profile. It is deep rooted so is good during dry times and provides good quality growth later in the season when grass is slowing up. White clover inclusion will limit weed control options.

Establishment	
Soil pH	Clover is sensitive to pH (aim for pH 6.0-6.5) so ensure liming is kept up to date. Apply lime at a rate of 2.4 t/ha (1 t/ac) per year until the problem is resolved. Do not use magnesium (Dolomitic) lime unless on magnesium deficient soil.
Timing	Spring or Autumn. Clover is vulnerable to drops in soil temperature so ensure soils are warm before sowing. For this reason it can be difficult to establish clover very late in the Autumn.
Sowing	Roll to ensure good seed to soil contact is especially important for clover seed. Don't plant more than 1 cm (½") deep. Can be oversown at 5 kg/ha (2 kg/ac), but be careful to limit the competition from the existing sward
Seed selection	Choose clover varieties to suit the grazing requirements. Large leaf clovers for cattle, small leaf for sheep.
Fertiliser	Check P & K status and adjust accordingly. 50-75 kg/ha (40-60 units/ac) N may be incorporated into the seedbed. Be aware of NVZ limitations on spreading muck and fertiliser in the Autumn
Pests	Rolling will decrease the chance of slug damage, but look out for slime trails and act promptly at the first sign of damage

Growing	
Fertiliser Refer to DEFRA's RB209 for more details	Use slurry and dirty water wherever possible to reduce bagged fertiliser inputs. Ideally this should be injected or applied below the grass canopy with a trailing shoe to minimise the time until stock will graze the sward again. Fertiliser requirements will be lower where good levels of white clover are established as white clover can provide 200 kg/ha (160 units/ac) of nitrogen. Reduce nitrogen rates relative to swards without clover, especially later in the season when the ground is warm and the clover is producing N. P and K needs to be balanced according to soil analysis.
Weeds	Keeping on top of weeds in long-term clover rich swards is more problematic. Clover safe grassland sprays can be effective, though repeated applications to keep on top of problems are better than letting weed burden build up. Weed wipers can be used to selectively target weed species.
Pests	Look out for leather jacket damage and spray if necessary

Grazing	
	See Grazed Grass section
Bloat	Modern clover varieties pose less of a bloat risk, but if clover levels get very high then reduce the risk by feeding a buffer and ensuring animals do not go onto clover rich swards when they are hungry.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
			Sow					Sow			
Graze											

Typical Yield and Quality

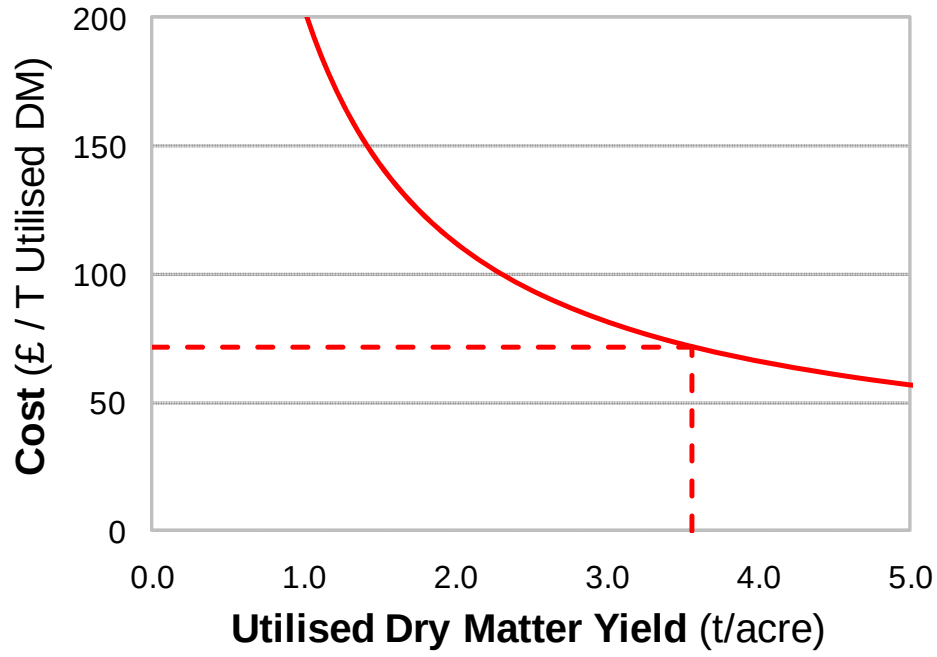
Fresh Yield	65 t/ha (26 t/ac)
Dry Matter	17%
Dry Matter Yield	11 t/ha (4.5 t/ac)
Percentage of dry matter that is utilised	80 %
Utilised Dry Matter Yield	8.8 t/ha (3.6 t/ac)
Energy	11.5 MJ/KG DM
Crude Protein	19% in DM

Typical Cost & Value (5 year ley)

	Total Costs	Cash Costs[1]
Cost per Hectare	£631	£411
Cost per tonne fresh weight	£10	£6
Cost per tonne utilised dry matter	£72	£47
Cost per MJ of metabolisable energy	0.6p	0.4p
Cost per 100g of Crude Protein	3.8p	2.5p

[1]Establishment, variable and machinery costs, excluding rent and clamp depreciation

PRODUCTION COSTS RELATIVE TO CROP YIELD



Solid red line:
Production cost depending on yield

Broken red line:
Yield and production costs for the example given in the tables

Even at a moderate yield grazed grass with White Clover is good value. Managed well it is excellent value.

GRAZED GRASS WITH LOW NITROGEN INPUT

Grazing swards containing high levels of white clover can offer cheap forage as fertiliser levels can be cut back later in the season. Whilst cutting the levels of bagged N to very low levels will allow the clover to better compete there is likely to be a small yield penalty as the grasses are less competitive. White clover in the sward will reduce the requirement for bagged N and improve the palatability of the sward, but will limit the spray options for control of weeds.

Establishment	
Soil pH	Clover is sensitive to pH (aim for pH 6.0-6.5) so ensure liming is kept up to date. Apply lime at a rate of 2.4 t/ha (1 t/ac) per year until the problem is resolved. Do not use magnesium (Dolomitic) lime unless on very light soil.
Timing	Spring or Autumn. Clover is vulnerable to drops in soil temperature so ensure soils are warm before sowing. For this reason it can be difficult to establish clover very late in the Autumn.
Sowing	Roll to ensure good seed to soil contact is especially important for clover seed. Don't plant more than 1cm deep.
Seed selection	Choose clover varieties to suit the grazing requirements. Large leaf clovers for cattle, small leaf for sheep.
Fertiliser	Check P & K status and adjust accordingly. 50-75 kg/ha (40-60 units/ac) N may be incorporated into the seedbed. Be aware of NVZ limitations on spreading muck and fertiliser in the Autumn
Pests	Act promptly at the first sign of slug damage

Growing	
Fertiliser Refer to DEFRA's RB209 for more details	Use slurry and dirty water wherever possible to reduce bagged fertiliser inputs. Ideally this should be injected or applied below the grass canopy with a trailing shoe to minimise the time until cows will graze the sward again. Fertiliser requirements will be lower where good levels of white clover are established as white clover can provide 200 kg/ha (160 units/ac) of nitrogen. Reduce nitrogen rates, especially later in the season when the ground is warm and the clover is producing N. P and K needs to be balanced according to soil analysis.
Weeds	Keeping on top of weeds in long-term clover rich swards is more problematic. Clover safe grassland sprays can be effective, though repeated applications to keep on top of problems are better than letting weed burden build up
Pests	Look out for leather jacket damage and spray if necessary

Grazing	
	See Grazed Grass section. Clover levels will vary through the season, being slower to grow in spring and being very competitive in the summer where levels can be around 30% in the sward.
Bloat	Modern clover varieties pose less of a bloat risk, but if clover levels get very high then reduce the risk by feeding a buffer and ensuring cows do not go onto clover rich swards when they are hungry.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
			Sow					Sow			
Graze											

Typical Yield and Quality

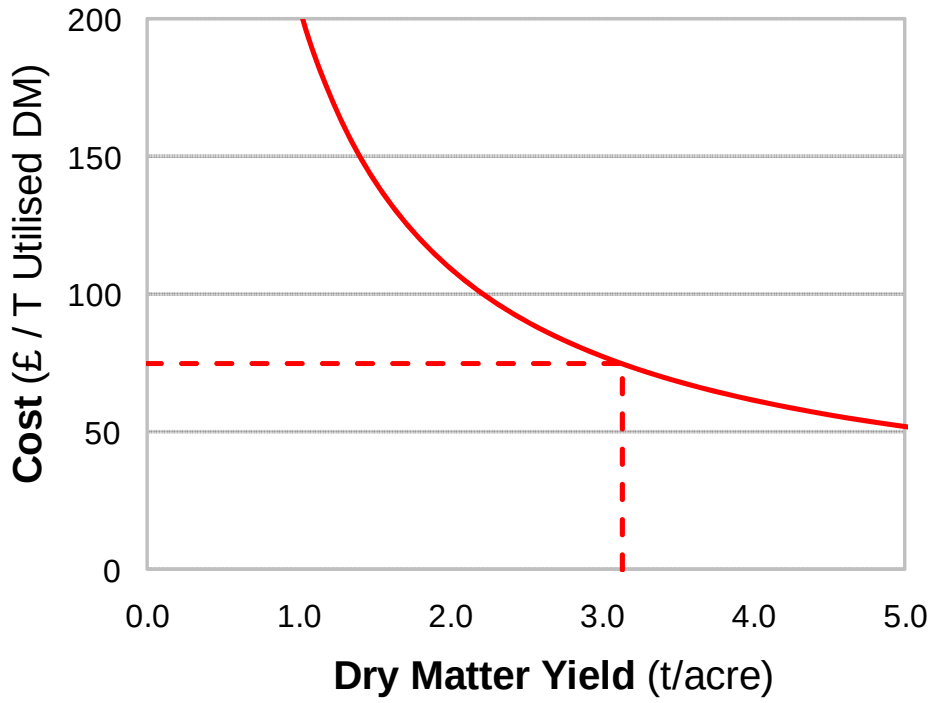
Fresh Yield	57 t/ha (23 t/ac)
Dry Matter	17%
Dry Matter Yield	10 t/ha (3.9 t/ac)
Percentage of dry matter that is utilised	80 %
Utilised Dry Matter Yield	7.8 t/ha (3.1 t/ac)
Energy	11.5 MJ/KG DM
Crude Protein	19% in DM

Typical Cost & Value (5 year ley)

	Total Costs	Cash Costs[1]
Cost per Hectare	£580	£360
Cost per tonne fresh weight	£10	£6
Cost per tonne utilised dry matter	£75	£46
Cost per MJ of metabolisable energy	0.6p	0.4p
Cost per 100g of Crude Protein	3.9p	2.4p

[1]Establishment, variable and machinery costs, excluding rent and clamp depreciation

PRODUCTION COSTS RELATIVE TO CROP YIELD



Solid red line:
Production cost depending on yield

Broken red line:
Yield and production costs for the example given in the tables

Where fertiliser applications are targeted to the times of the year when clover is less productive then reasonable forage yields can be achieved at low cost.

GRAZED GRASS – POOR QUALITY SWARD

Grazed grass is one of the cheapest forages on farm, yet if swards are not well grazed or reseeded regularly then the proportion of meadow grasses and weed species will increase. This can significantly reduce yields as weed species are lower yielding and less responsive to nutrients. Whilst this will save input costs in the short term, as yields drop the cost per tonne of forage will increase and the nutritional value of the forage will decline.
These swards can be improved by addressing soil pH issues, improving fertility and introducing more competitive grass species as well as a full reseed.
Whilst these swards may have low agricultural value they may have other benefits that could attract environmental scheme payments.

Establishment	
Fertiliser Refer to DEFRA's RB209 for more details	Use slurry and dirty water wherever possible to reduce bagged fertiliser inputs. Ideally this should be injected or applied below the grass canopy with a trailing shoe to minimise the time until cows will graze the sward again. Low quality swards will be less responsive to nitrogen than top quality. Reduce fertiliser inputs to allow for this. P and K needs to be balanced according to soil analysis.
Weeds	Whilst weed grass species will inevitably increase in older pastures it is important to keep on top of weeds numbers as this will hasten the decline of pasture quality.
Pests	Look out for leather jacket damage and spray if necessary.

Growing	
Fertiliser	Poor quality swards are not very responsive to nitrogen so cut back inputs

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
			Sow					Sow			
Graze											

Typical Yield and Quality

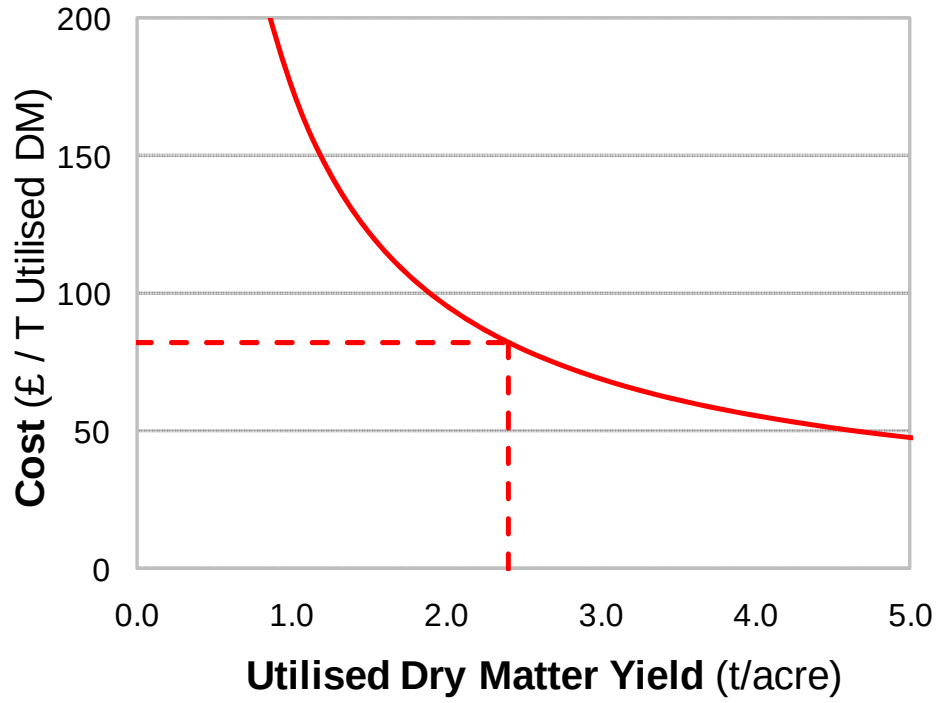
Fresh Yield	50 t/ha (20 t/ac)
Dry Matter	17%
Dry Matter Yield	8.5 t/ha (3.4 t/ac)
Percentage of dry matter that is utilised	70%
Utilised Dry Matter Yield	6 t/ha (2.4t/ac)
Energy	10.5 MJ/KG DM
Crude Protein	15% in DM

Typical Cost & Value (permanent pasture)

	Total Costs	Cash Costs[1]
Cost per Hectare	£490	£270
Cost per tonne fresh weight	£10	£5
Cost per tonne utilised dry matter	£82	£45
Cost per MJ of metabolisable energy	0.8p	0.4p
Cost per 100g of Crude Protein	5.5p	3.0p

[1]Establishment, variable and machinery costs, excluding rent and clamp depreciation

PRODUCTION COSTS RELATIVE TO CROP YIELD



Solid red line:
Production cost depending on yield

Broken red line:
Yield and production costs for the example given in the tables

Poor quality swards are expensive relative to the cost of oversowing or reseeding, when this is spread over the lifetime of the ley.

CHICORY, RYEGRASS AND WHITE CLOVER

Chicory is a very digestible perennial herb with a deep tap route and high mineral concentrations, making it ideal for lamb and cattle over the summer period. To obtain the best results combine chicory with a legume to provide the nitrogen required for the sward.

Establishment	
Timing	Spring or autumn sown up to the end of August when combining with ryegrass.
Variety selection	It is important to select the correct variety to suit the farm requirements. A persistent perennial variety is essential when mixed with grass and clover.
Sowing	Cultivate to achieve a firm, fine seedbed, roll to ensure good soil contact, Sow no deeper than 1 cm (½"). Be aware of the capping risk with fine seedbeds. The crop is sensitive to temperature so it is recommended to sow above 10^{o}C, usually in the spring.
Fertiliser	Check P&K status and adjust accordingly. 75-85 kg N/ha (60-70 units N/ac) may be incorporated into the seedbed, though account for muck applications. Whilst Chicory is very acid tolerant, a low pH will reduce the competitiveness of the clover. Lime at 2.4 t/ha (1 t/ac) to keep pH between 6.0 and 6.5.

Growing	
Pests	Act promptly on the first sign of slug damage. Look out for leather jacks and spray if necessary.
Weeds	There are no chicory safe sprays.

Feeding	
Grazing	It is recommended within the first grazing season to graze lightly on a rotational system. Optimum grazing height is between 15-20 cm (6 - 8"), Grazing below the recommended level could result in crown damage and reduced persistency. Winter grazing can cause damage, so ensure grazings are light.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		Drill					Drill				
				Graze							

Typical Yield and Quality

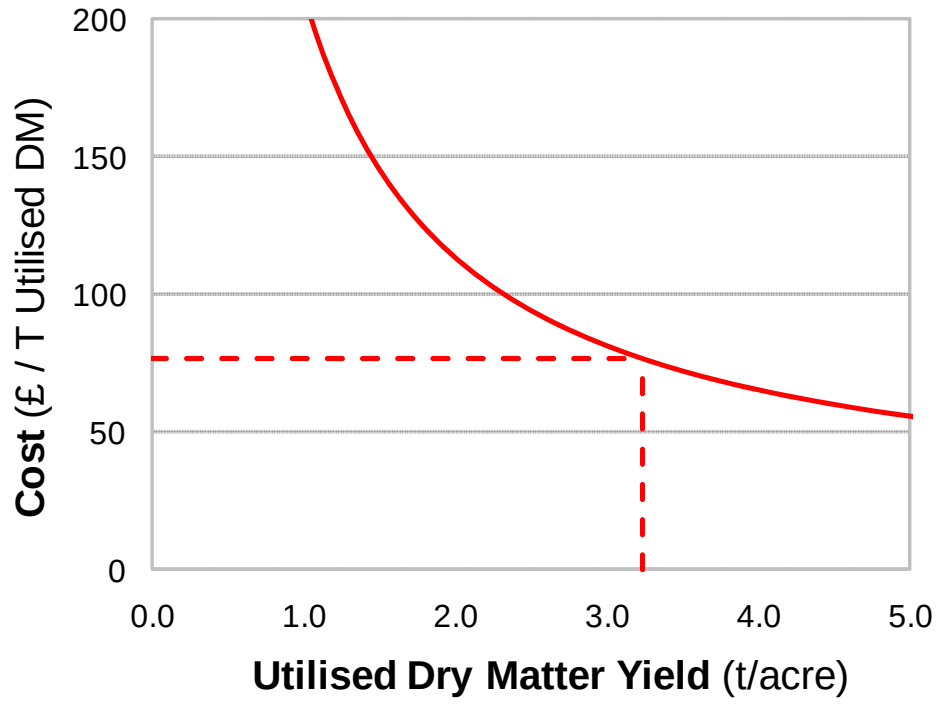
Fresh Yield	67 t/ha (27 t/ac)
Dry Matter	15%
Dry Matter Yield	10 t/ha (4 t/ac)
Percentage of dry matter that is utilised	80%
Utilised Dry Matter Yield	8 t/ha (3.2 t/ac)
Energy	11 MJ/KG DM
Crude Protein	20% in DM

Typical Cost & Value (3 year ley)

	Total Costs	Cash Costs[1]
Cost per Hectare	£615	£395
Cost per tonne fresh weight	£9	£6
Cost per tonne utilised dry matter	£77	£49
Cost per MJ of metabolisable energy	0.7p	0.4p
Cost per 100g of Crude Protein	3.8p	2.5p

[1]Establishment, variable and machinery costs, excluding rent and clamp depreciation

PRODUCTION COSTS RELATIVE TO CROP YIELD



Solid red line:
Production cost depending on yield

Broken red line:
Yield and production costs for the example given in the tables

Manage the chicory carefully to avoid it being grazed out or going to seed. This sward mixture will promote soil structure and stock health

SUMMER TURNIPS

Summer turnips are very useful for providing a buffer feed during dry summer months and into the early Autumn. They are also a low cost option for finishing lambs. Sown after an early 1st cut they will utilise large quantities of FYM for most of their nutrients and provide good feed before reseeding in the Autumn.

Establishment	
Timing	Spring – After an early 1st silage cut
Variety selection	Chose varieties to suit the desired grazing period. Look also for DM yield, leaf to root ratio and resistance to diseases such as clubroot.
Sowing	Cultivate to achieve a fine, firm seedbed. Roll to ensure good seed to soil contact. Sow at 5 kg/ha (2 kg/ac) if drilled or 7.5 kg/ha (3 kg/ac) if broadcast
Rotation	Do not grow continuously, ideally at least on a 5 year rotation
Fertiliser	Check P & K status and adjust accordingly. 75-85 kg N/ha (60-70 units/ac) may be incorporated into the seedbed, although account for muck applications. Refer to DEFRA's RB209 for more details Lime at 2.5 t/ha (1t/ac) to keep pH between 6.0 and 6.5

Growing	
Pests	Watch out for flea beetle attack, spray at the first sign of trouble. Consider using treated seed.

Feeding	
Feeding	Allow 8-11 weeks from sowing to grazing. Strip grazing stock is essential to minimise waste. Move the fence daily to allow stock to feed under the fence. The longer and thinner the new strip they are given the better. If summer turnips are a larger proportion of the diet, e.g. for lambs, then ensure an additional fibre source is available so that brassicas do not make up more than 70% of the diet

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
			Sow								
						Graze					

Typical Yield and Quality

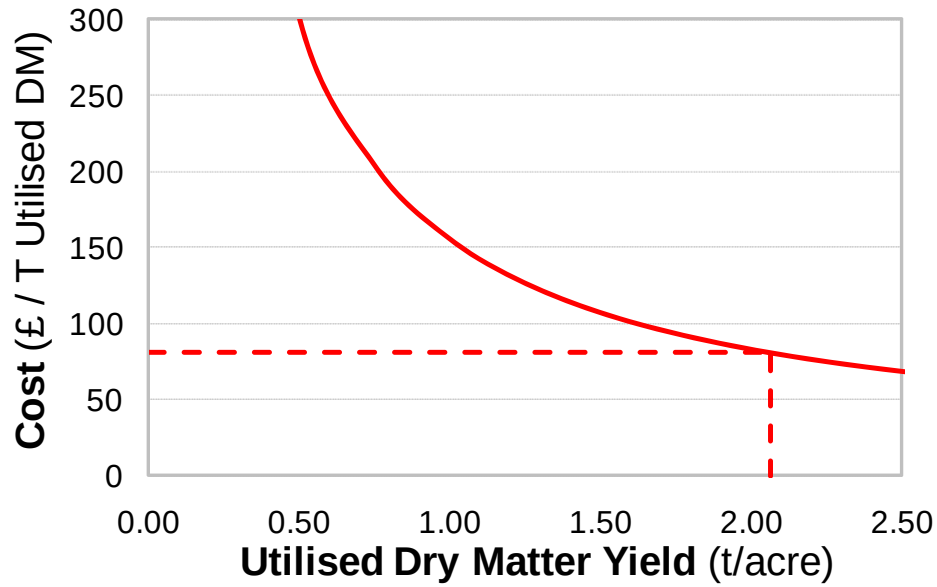
Fresh Yield	67 t/ha (27 t/ac)
Dry Matter	9%
Dry Matter Yield	6 t/ha (2.4 t/ac)
Percentage of dry matter that is utilised	85%
Utilised Dry Matter Yield	5.1 t/ha (2.1 t/ac)
Energy	11.2 MJ/KG DM
Crude Protein	17% in DM

Typical Cost & Value

	Total Costs	Cash Costs[1]
Cost per Hectare	£413	£308
Cost per tonne fresh weight	£6	£5
Cost per tonne utilised dry matter	£81	£60
Cost per MJ of metabolisable energy	0.7p	0.5p
Cost per 100g of Crude Protein	4.8p	3.6p

[1]Establishment, variable and machinery costs, excluding rent and clamp depreciation

PRODUCTION COSTS RELATIVE TO CROP YIELD



Solid red line:
Production cost depending on yield

Broken red line:
Yield and production costs for the example given in the tables

Summer Turnips are good value before an Autumn reseed

GRAZING KALE

Kale is useful for providing a buffer feed during dry summer months and into mid Autumn. It is also a low cost option for finishing lambs. Sown after an early 1st cut it will utilise large quantities of FYM for most of its nutrients. Kale will last longer into the Autumn than spring sown turnips so can be sown behind turnips to extend the time you can offer additional forages.

Establishment	
Timing	Spring – After an early 1st cut
Variety selection	Chose varieties to suit the desired grazing period, considering the following: Winter hardiness, height, lodging resistance, disease resistance, palatability and digestibility. Consider Rape/Kale hybrids for a combination of fast growth and good quality.
Sowing	Cultivate to achieve a fine, firm seedbed. Roll to ensure good seed–soil contact. Sow at a seed rate of 2.5 – 5.0 kg/ha (1-2 kg/ac) if drilled or 7.5 kg/ha (3 kg/ac) if broadcast.
Rotation	Do not grow continuously, ideally at least on a 5 year rotation, especially if clubroot has been a problem. Club root resistant varieties are now available.
Fertiliser	Check P & K status and adjust accordingly. 75-85 kg N/ha (60-70 units N per ac) may be incorporated into the seedbed, though account for muck applications. Lime at 2.4 t/ha (1 t/ac) to keep pH between 6.0 and 6.5 Refer to DEFRA's RB209 for more details

Growing	
Pests	Watch out for flea beetle attack, spray at the first sign of trouble. Consider using treated seed. Look out for slug damage, especially in direct drilled crops.

Feeding	
Feeding	Allow 12-14 weeks from sowing to feeding. Strip grazing stock is essential to minimise waste, move the fence daily to allow them to feed under the fence. Provide lambs and beef cattle with a grass area and plenty of straw or hay as a fibre source.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
				Sow							
Graze							Graze				

Typical Yield and Quality

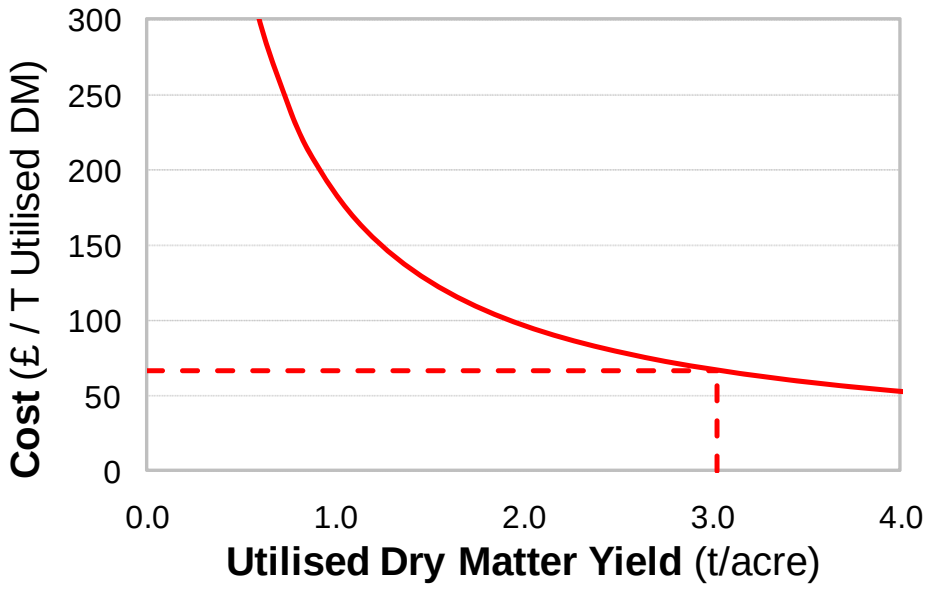
Fresh Yield	59 t/ha (24 t/ac)
Dry Matter	15%
Dry Matter Yield	8.8 t/ha (3.6 t/ac)
Percentage of dry matter that is utilised	85%
Utilised Dry Matter Yield	7.5 t/ha (3.0 t/ac)
Energy	11 MJ/KG DM
Crude Protein	17% in DM

Typical Cost & Value

	Total Costs	Cash Costs[1]
Cost per Hectare	£499	£382
Cost per tonne fresh weight	£9	£7
Cost per tonne utilised dry matter	£67	£51
Cost per MJ of metabolisable energy	0.6p	0.5p
Cost per 100g of Crude Protein	4.0p	3.0p

[1]Establishment, variable and machinery costs, excluding rent and clamp depreciation

PRODUCTION COSTS RELATIVE TO CROP YIELD



Solid red line:
Production cost depending on yield

Broken red line:
Yield and production costs for the example given in the tables

Kale offers high quality feed at low cost. Keep on top of any disease or pest problems and minimise waste to get the best out of it.

FORAGE RAPE

Forage Rape is useful for providing high protein forage with good winter hardiness.
Sown after 1st cut, or behind an early cereal harvest, it will utilise large quantities of FYM for most of its nutrients. Rape will last longer into the Autumn than summer turnips or kale, so can be sown behind them to extend the season later into the year, or mixed with them to increase protein levels.

Establishment	
Timing	After 1st cut silage, or behind cereals, especially if they are taken early for whole crop.
Variety selection	Chose varieties with good disease resistance, especially to powdery mildew. Consider Rape/Kale hybrids for a combination of fast growth and good quality.
Sowing	Cultivate to achieve a fine, firm seedbed. Roll to ensure good seed–soil contact. Sow at a seed rate of 6.2 kg/ha (2.5 kg/ac) if drilled or 10 kg/ha (4 kg/ac) if broadcast.
Fertiliser	Lime at 2.5 t/ha (1 t/ac) to keep pH between 6.0 and 6.5 Check P & K status and adjust accordingly. Muck should provide most of the nutrient requirements, though up to 100kg of N is required in total. Refer to DEFRA's RB209 for more details.

Growing	
Weeds	Make sure the seed bed is clean before sowing and monitor weed burden as the rape establishes as it is venerable to competition.
Pests	Watch out for flea beetle attack, spray at the first sign of trouble. Consider using seed treated against flee beetle. Look out for slug damage in direct drilled crops.

Feeding	
Feeding	Typically allow 13 - 15 weeks from sowing to feeding, although this is dependent on variety choice an season. Strip grazing cattle is essential to minimise waste, though sheep can be block grazed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
				Sow							
								Graze			

Typical Yield and Quality

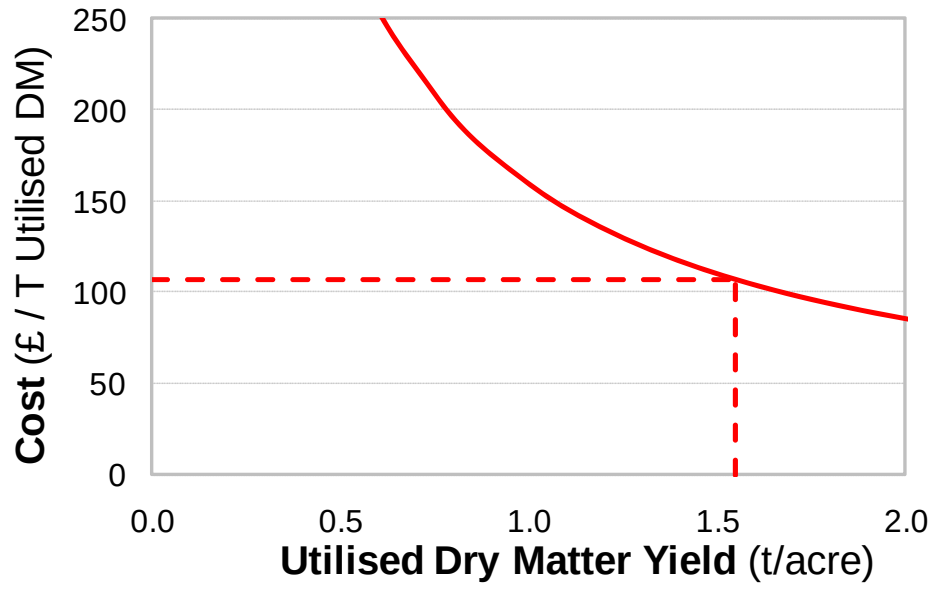
Fresh Yield	35 t/ha (14 t/ac)
Dry Matter	13%
Dry Matter Yield	4.5 t/ha (1.8 t/ac)
Percentage of dry matter that is utilised	85 %
Utilised Dry Matter Yield	3.8 t/ha (1.5 t/ac)
Energy	10.5 MJ/KG DM
Crude Protein	19% in DM

Typical Cost & Value

	Total Costs	Cash Costs[1]
Cost per Hectare	£410	£293
Cost per tonne fresh weight	£12	£8
Cost per tonne utilised dry matter	£107	£77
Cost per MJ of metabolisable energy	1.0p	0.7p
Cost per 100g of Crude Protein	5.6p	4.0p

[1]Establishment, variable and machinery costs, excluding rent and clamp depreciation

PRODUCTION COSTS RELATIVE TO CROP YIELD



Solid red line:
Production cost depending on yield

Broken red line:
Yield and production costs for the example given in the tables

Forage Rape is useful where you need a higher protein forage. It's relatively low yield makes it more expensive than other grazed forage crops however on lighter ground it allows stock to be grazed outside into the winter.

STUBBLE TURNIPS

Stubble turnips are cheap to establish and provide a good quality winter feed which is excellent for out wintering stock. Dry ground and an adjacent area of grass for stock to run back onto helps keep animals clean. Placing bales of straw, hay or silage in the field when it is sown, or when conditions are dry, provides a good fibre source necessary to regulate consumption of the fodder crop to 30% of the daily dry matter intake.

Establishment	
Timing	Summer, after harvest, into cereal stubbles.
Variety selection	Chose varieties to suit the desired grazing period. Look also for DM yield, leaf to root ratio and resistance to diseases such as clubroot.
Sowing	Direct drill into stubble at a seed rate of 5 kg/ha (2 kg/ac)
Fertiliser	Lime at 2.5 t/ha (1 t/ac) per year to target a pH's of 6.5 Check P & K status and adjust accordingly. 75-85 kg N/ha (60-70 units of N/ac) may be incorporated into the seedbed, though account for muck applications. Refer to DEFRA's RB209 for more details.

Growing	
Pests	Watch out for flea beetle attack, spray at the first sign of trouble. Consider using treated seed to reduce the risk of flea beetle attack. Look out for slug damage in direct drilled crops.

Feeding	
Feeding	Allow 10-14 weeks from sowing to feeding. Strip grazing cattle is essential to minimise waste, move the fence daily to allow cows to feed under the fence. Sheep can be block grazed. Provide a fibre source, e.g. by placing straw in the field before the crop grows. Allow stock to run back onto a dry grass area.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
						Sow					
									Graze		

Typical Yield and Quality

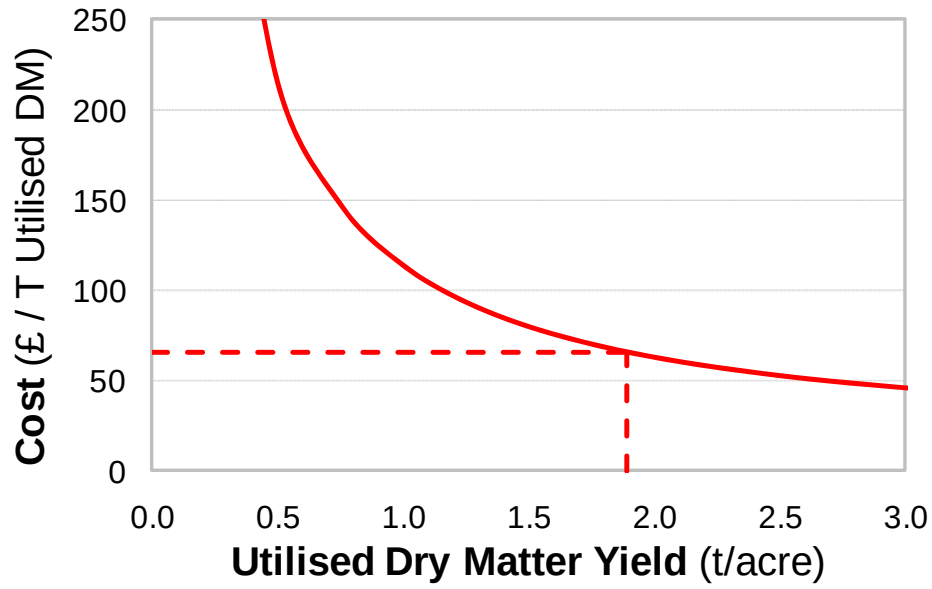
Fresh Yield	61 t/ha (25 t/ac)
Dry Matter	9%
Dry Matter Yield	5.5 t/ha (2.2 t/ac)
Percentage of dry matter that is utilised	85%
Utilised Dry Matter Yield	4.7 t/ha (1.9 t/ac)
Energy	11.2 MJ/KG DM
Crude Protein	17% in DM

Typical Cost & Value

	Total Costs	Cash Costs[1]
Cost per Hectare	£307	£218
Cost per tonne fresh weight	£5	£4
Cost per tonne utilised dry matter	£66	£47
Cost per MJ of metabolisable energy	0.6p	0.4p
Cost per 100g of Crude Protein	3.9p	2.7p

[1]Establishment, variable and machinery costs, excluding rent and clamp depreciation

PRODUCTION COSTS RELATIVE TO CROP YIELD



Solid red line:
Production cost depending on yield

Broken red line:
Yield and production costs for the example given in the tables

Stubble Turnips are a low cost winter feed which on dry ground allows winter keep costs to be minimised.

SWEDES

Swedes provide good winter keep for sheep and cattle, although they can be hard on animals with weak teeth (young or old). Dry ground without compaction is important for good yields and to keep stock as clean as possible.
Properly grown, yields will be very high and consequently the cost per tonne will be very low.

Establishment	
Timing	April to June
Variety selection	Choose varieties to suit the desired grazing period, either Autumn or Winter.
Sowing	Cultivate to achieve a fine, firm seedbed. Drill with a precision drill at about 0.5 kg/ha (0.2kg/ac) to a depth of 1-2 cm (½ inch). Row spacings should be 40 cm (16”), seed spacing 6” (15cm)
Rotation	Do not grow continuously, ideally at least on a 5 year rotation
Fertiliser	Check P & K status and adjust accordingly. 75-85 kg N/ha (60-68 units of N/ac) may be incorporated into the seedbed, though account for muck applications. Lime at 2.5 t/ha (1 t/ac) to keep the pH at 6.5 Refer to DEFRA’s RB209 for more details

Growing	
Pests	Watch out for flea beetles in dry conditions.

Feeding	
Feeding	Strip grazing will minimise wastage.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
			Sow								
Graze									Graze		

Typical Yield and Quality

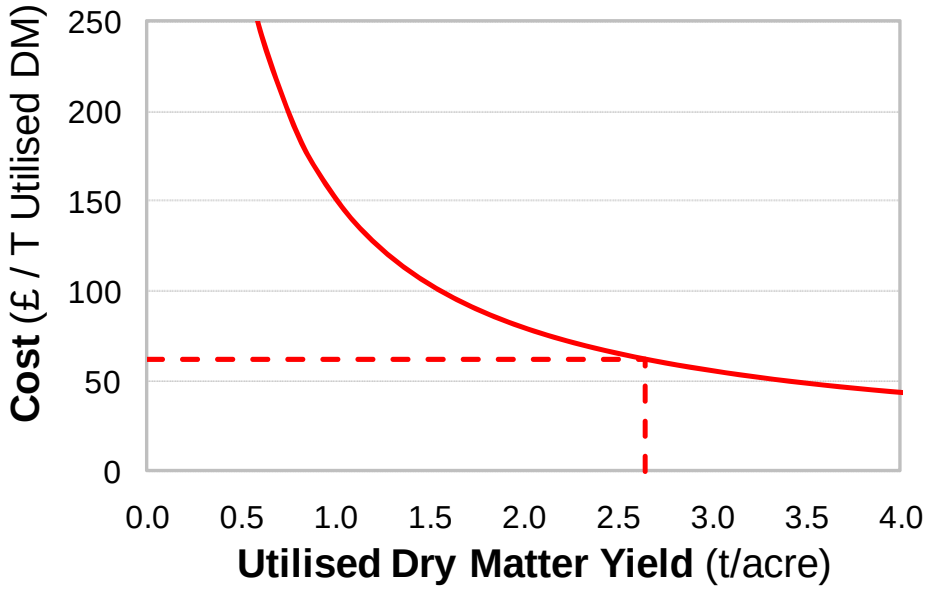
Fresh Yield	77 t/ha (31 t/ac)
Dry Matter	10%
Dry Matter Yield	7.7 t/ha (3.1 t/ac)
Percentage of dry matter that is utilised	85%
Utilised Dry Matter Yield	6.5 t/ha (2.6 t/ac)
Energy	12.9 MJ/KG DM
Crude Protein	10% in DM

Typical Cost & Value

	Total Costs	Cash Costs[1]
Cost per Hectare	£405	£286
Cost per tonne fresh weight	£5	£4
Cost per tonne utilised dry matter	£62	£44
Cost per MJ of metabolisable energy	0.5p	0.3p
Cost per 100g of Crude Protein	6.2p	4.4p

[1]Establishment, variable and machinery costs, excluding rent and clamp depreciation

PRODUCTION COSTS RELATIVE TO CROP YIELD



Solid red line:
Production cost depending on yield

Broken red line:
Yield and production costs for the example given in the tables

A well grown swede crop is a very cost effective feed. Even where yields are only moderate the crop is still good value.

FORAGE RYE

Forage Rye is a useful catch crop to go in after maize or cereals, providing winter sheep keep, young stock grazing, or an early bite in the spring. This can allow an early turnout, reducing overwintering costs.
Damage to the ground is not a major problem as it will be ploughed before returning to a spring crop. This crop will mop up residual nitrogen and reduce soil erosion. This is of growing importance, especially on maize ground which is prone to soil wash.

Establishment	
Timing	September or October
Weeds	A broad spectrum herbicide applied to the stubble before drilling should provide a clean enough seed bed so that the seeds can get away easily.
Sowing	Cultivate as cheaply as possible. Direct drill into stubble or lightly disk to produce a tilth before drilling. The less you disturb the ground the better the stock carrying capacity in the spring. Cross drilling gives a thicker sward. Drill at a seed rate of 170-185 kg/ha (65-75 kg/ac)
Fertiliser	Lime at 2.5 t/ha (1 t/ac) to keep pH's between 6.0 and 6.5 Forage Rye should need very little additional nutrients, especially if a light slurry application is applied. Check P & K status and adjust accordingly. Be aware of NVZ limitations on spreading muck and fertiliser in the Autumn Refer to DEFRA's RB209 for more details

Growing	
Pests and diseases	Forage rye suffers from few pest problems
Tillering	If the crop is planted early and the weather favourable then it can be over mature before winter. If this occurs a light grazing, when the crop is 10 cm (4") will improve the tillering, winter hardiness and spring growth.

Feeding	
Feeding	Potentially graze from late February onward, when the crop is 15 cm (6") tall. Strip grazing is essential to minimise waste. Move the fence daily. Early grazing will increase the likelihood that a second growth flush will occur before you need to plough out the crop.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
								Sow			
	Graze										Graze

Typical Yield and Quality

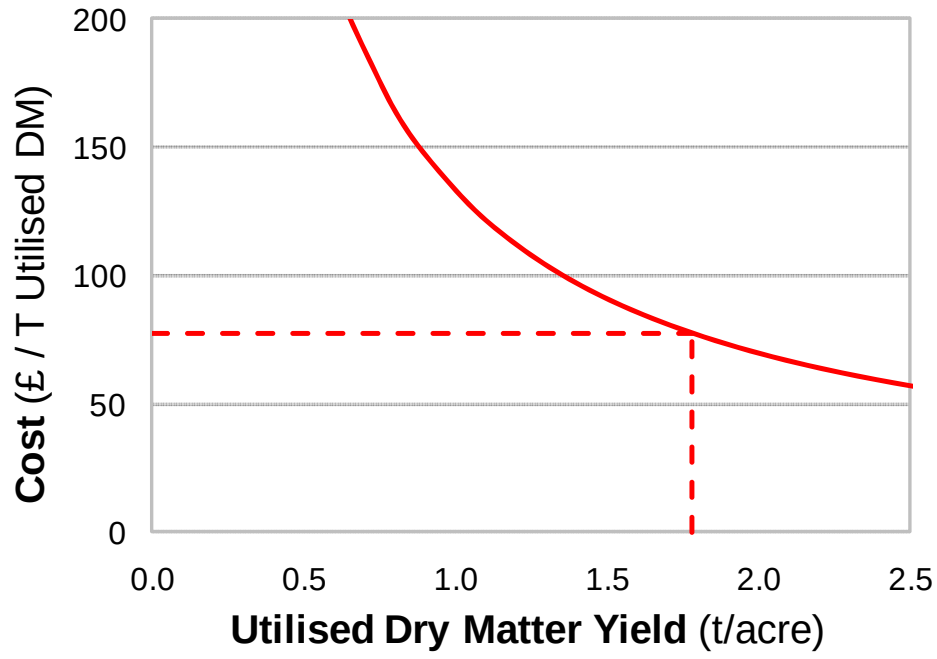
Fresh Yield	28 t/ha (11 t/ac)
Dry Matter	20%
Dry Matter Yield	5.5 t/ha (2.2 t/ac)
Percentage of dry matter that is utilised	80 %
Utilised Dry Matter Yield	4.4 t/ha (1.8 t/ac)
Energy	10 MJ/KG DM
Crude Protein	11% in DM

Typical Cost & Value (catch crop)

	Total Costs	Cash Costs[1]
Cost per Hectare	£342	£258
Cost per tonne fresh weight	£12	£9
Cost per tonne utilised dry matter	£78	£59
Cost per MJ of metabolisable energy	0.8p	0.6p
Cost per 100g of Crude Protein	7.1p	5.3p

[1]Establishment, variable and machinery costs, excluding rent and clamp depreciation

PRODUCTION COSTS RELATIVE TO CROP YIELD



Solid red line:
Production cost depending on yield

Broken red line:
Yield and production costs for the example given in the tables

Forage Rye is environmentally useful and can provide an early bite in spring. Its relatively high seed cost makes this crop more expensive than many other crops, especially if an excellent yield is not achieved. The grazing season is also rather short.

1ST CUT GRASS SILAGE

1st cut grass silage can be a top quality high value forage. The best silages are made where muck and fertiliser are applied in good time so an early cut can be taken if the weather and crop allow. Silage quality is directly related to the quality of the grass used to make it.

Establishment	
Timing	Spring or Autumn
Sowing	Cultivate to achieve a fine, firm seedbed or direct drill into an existing sward. Roll to ensure good seed–soil contact.
Seed selection	Select quality grass varieties and match them to the job they need to do, e.g. cutting or cutting followed by grazing. Sow with white clover wherever weed burdens allow. Match heading dates to your typical cutting date.
Fertiliser	Check P & K status and adjust accordingly. 50-75 kg/ha N (40-60 units/ac of N) may be incorporated into the seedbed. Be aware of NVZ limitations on spreading muck and fertiliser in the Autumn.

Growing	
Soil pH	Soil acidity has a huge effect on grass production. Aim for a pH of 6.0 - 6.5. Apply lime at a rate of 2.5 t/ha (1 t/ac) per year until the problem is resolved. Be aware of the lime type you are using, avoid magnesium (Dolomitic) lime unless the soil is very light.
Rolling	Routine rolling in the spring is an expensive waste of time. Only roll fields where soil contamination of the silage or stones damaging the machines will be a problem.
Fertiliser Refer to DEFRA's RB209 for more details	Apply slurry a minimum of 6 weeks before harvest unless injected or applied below the grass canopy with a trailing shoe. Fertiliser requirements will vary widely but typical fertiliser N allowances are 130 kg N/ha (100 units/ac) applied in a split dose, 40-60 kg/ha (30 – 50 units/ac) of N in late February/early March, and the remainder a month later. Increase to 150 kg/ha (120 units/ac) where no slurry is applied. Allow 1 day for every 2.5kg N/ha between application and mowing

Harvesting	
Harvest date	Assuming you have got the fertiliser on in good time then cutting a young sward, before it has headed will maximise silage quality.
Cutting	Leave 7.5 cm (3") stubble to avoid soil contamination and promote regrowth. Ideally cut when the grass sugars are highest, i.e. later in the day
Wilting	Wilt to 25-30% DM, providing this can be done within a 24 hour period after cutting, preferably within 12 hours.
Chop length	5-7.5 cm (2-3 inches). Chop longer if wet, shorter if dry, as this aids compaction in the clamp and reduces aerobic spoilage

Harvesting	
Additive	Applying an additive will not make up for poor silage making. Sunshine is the best additive! If using an additive, select the correct type for the job you want it to do.
Clamping	Fill the clamp in thin layers and roll, roll and roll some more. Sheet as soon as possible and ensure a good seal

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		Sow					Sow				
				Cut							

Typical Yield and Quality

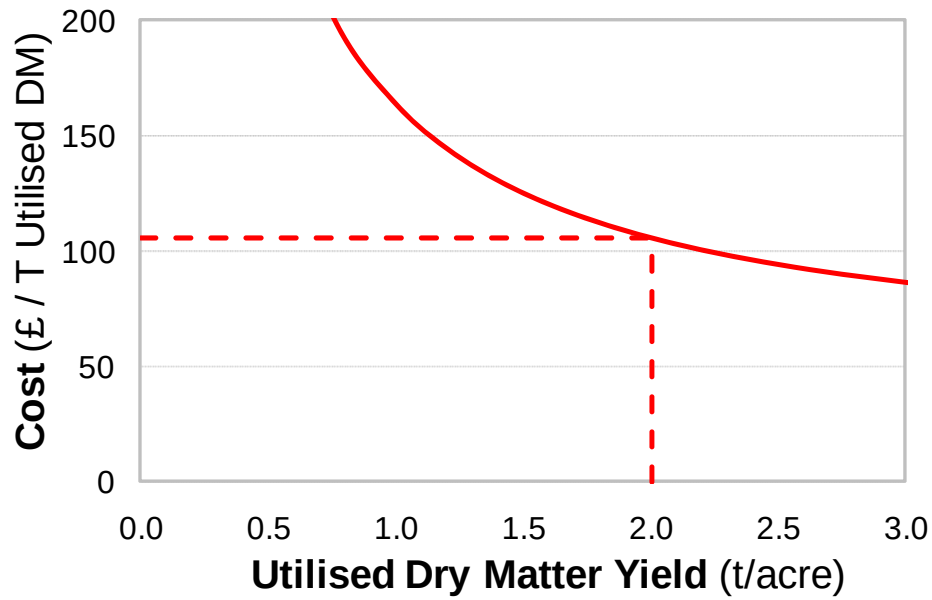
Fresh Yield	23 t/ha (9 t/ac)
Dry Matter	25%
Dry Matter Yield	5.7 t/ha (2.3 t/ac)
Percentage of dry matter that is utilised	87%
Utilised Dry Matter Yield	5 t/ha (2 t/ac)
Energy	11.2 MJ/KG DM
Crude Protein	15% in DM

Typical Cost & Value (5 year ley)

	Total Costs	Cash Costs[1]
Cost per Hectare	£523	£376
Cost per tonne fresh weight	£23	£16
Cost per tonne utilised dry matter	£105	£76
Cost per MJ of metabolisable energy	0.9p	0.7p
Cost per 100g of Crude Protein	7p	4.1p

[1]Establishment, variable and machinery costs, excluding rent and clamp depreciation

PRODUCTION COSTS RELATIVE TO CROP YIELD



Solid red line:
Production cost depending on yield

Broken red line:
Yield and production costs for the example given in the tables

1st cut grass silage is a good value feed, especially if yields are good and waste is minimised. Plan early, feed it well, keep weeds under control and harvest on time.

1ST CUT GRASS SILAGE – LATE CUT

1st cut grass silage, taken later, gives a bulky, lower quality forage. This can be perfect for beef cattle and where production levels do not dictate that the best quality forages are fed. This more mature forage is good for rumen health, though can be prone to heating at feed out if poorly consolidated.

Growing	
	Treat as for conventional 1st cut

Harvesting	
Harvest date	Let it grow on for an additional 2-4 weeks beyond conventional 1st cut to increase bulk.
Cutting	Can be problematic if the grass lodges.
Wilting	Good weather is essential as you will have a very bulky crop to wilt. Spread the swaths completely and use a conditioner where possible to speed the wilting process. Aim to have the crop in the clamp within 24 hours of cutting, preferably at 25-30% dry matter.
Chop length	As the crop is more mature, you can afford to chop it a little shorter without losing the scratch factor – 5 cm (2 inches) minimum.

Ensiling	
Additive	If using an additive, select one for the job it needs to do. Few additives are good for controlling heating and improving the fermentation. Select carefully.
Clamping	Effective rolling is essential with this crop. Put a second tractor on the clamp. Roll, roll and roll some more.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		Sow					Sow				
					Cut						

Typical Yield and Quality

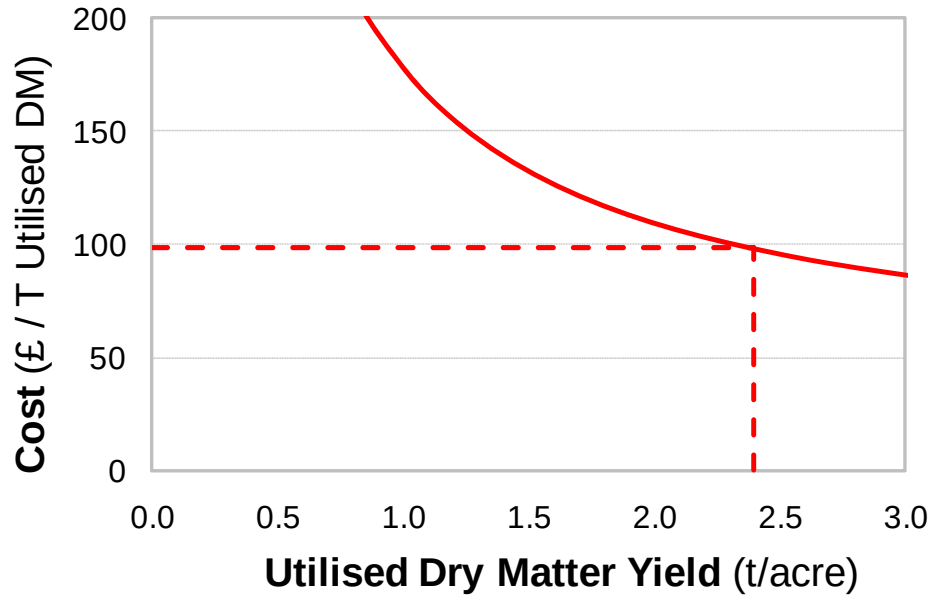
Fresh Yield	25 t/ha (10 t/ac)
Dry Matter	27%
Dry Matter Yield	6.8 t/ha (2.8 t/ac)
Percentage of dry matter that is utilised	87 %
Utilised Dry Matter Yield	5.9 t/ha (2.4 t/ac)
Energy	10.8 MJ/KG DM
Crude Protein	13% in DM

Typical Cost & Value (5 year ley)

	Total Costs	Cash Costs[1]
Cost per Hectare	£581	£397
Cost per tonne fresh weight	£23	£16
Cost per tonne utilised dry matter	£98	£67
Cost per MJ of metabolisable energy	0.9p	0.6p
Cost per 100g of Crude Protein	7.6p	5.2p

[1]Establishment, variable and machinery costs, excluding rent and clamp depreciation

PRODUCTION COSTS RELATIVE TO CROP YIELD



Solid red line:
Production cost depending on yield

Broken red line:
Yield and production costs for the example given in the tables

Where top quality silage is not critical, taking a later 1st cut will result in a good value feed. Follow best practice to ensure good yields and well preserved silage.

2ND CUT GRASS SILAGE

More expensive than 1st cut, but still good value if well grown. Get the fertiliser/slurry onto the 1st cut aftermath as soon as possible after harvest to encourage good yields.

Growing	
Fertiliser Refer to DEFRA's RB209 for more details	Utilise slurry and dirty water onto the 1st cut aftermath as soon as possible after 1st cut, preferably by injection or using a trailing shoe. FYM is more problematic as it may be picked up in the silage. Composted FYM is less of a problem. An additional 60-80 kg N/ha (48-64 units N/ha) inorganic fertiliser can be applied at this time, depending on slurry nutrients supplied. Applying up to 100 kg N/ha (80 units N/ac) may be more suitable where no muck has been applied.
Weeds	Cutting the sward for silage will synchronise the growth of weeds so they are all at the ideal size to spray at the same time. This is especially true for weeds like docks and thistles. As they reach the rosette stage spray them with an effective translocated herbicide.

Harvesting	
Harvest date	Aim to cut the sward before it heads and loses nutritional quality.
Wilting	Be careful not to over wilt the 2nd cut, especially if it has got a little over mature and stemmy. Target 25-30% DM depending on the weather conditions. Aim to pick up within 12 hours. If the crop is drying rapidly then get it in as quickly as possible and pick up the last field directly behind the mower so you have some wetter forage to cap the clamp.
Chop length	Be aware of the difficulty of compacting long chop dry 2nd cut. This will tend to have high sugars and be prone to heating at feed out if it is poorly consolidated.

Ensiling	
Additive	Additives that control heating are likely to be the most useful for 2nd cut. Be aware that some types of additive will tend to make stability worse.
Clamping	If putting on top of 1st cut then be careful not to roll air into the 1st cut (the bellows effect). Avoid this by putting a complete layer of grass over the clamp before doing any rolling. Fill in thin layers and roll, roll and roll some more. Sheet as soon as possible and ensure a good seal

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		Sow						Sow			
						Cut					

Typical Yield and Quality

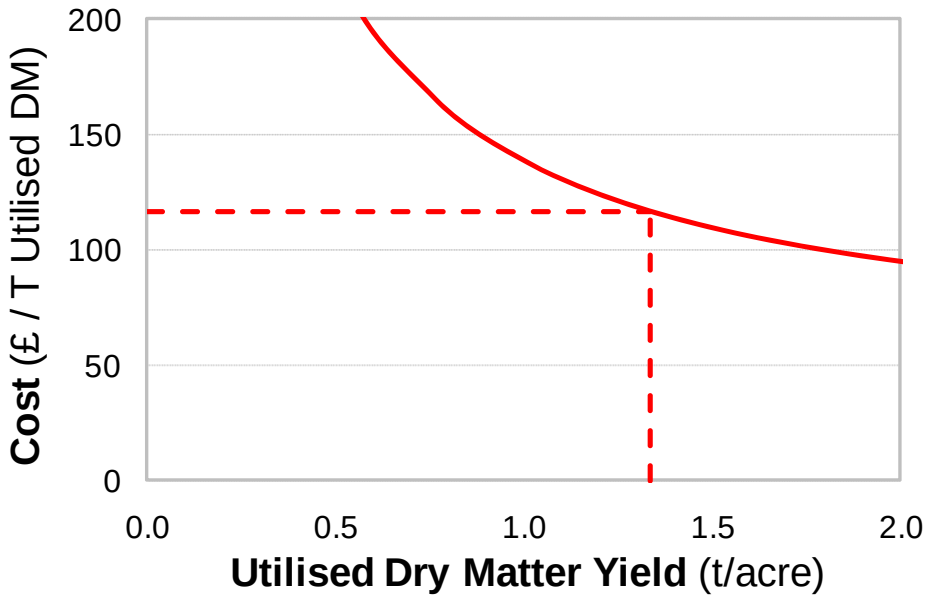
Fresh Yield	13 t/ha (5 t/ac)
Dry Matter	30%
Dry Matter Yield	3.8 t/ha (1.5 t/ac)
Percentage of dry matter that is utilised	87%
Utilised Dry Matter Yield	3.3 t/ha (1.3 t/ac)
Energy	11 MJ/KG DM
Crude Protein	14% in DM

Typical Cost & Value (5 year ley)

	Total Costs	Cash Costs[1]
Cost per Hectare	£385	£297
Cost per tonne fresh weight	£30	£23
Cost per tonne utilised dry matter	£116	£90
Cost per MJ of metabolisable energy	1.1p	0.8p
Cost per 100g of Crude Protein	8.3p	6.4p

[1]Establishment, variable and machinery costs, excluding rent and clamp depreciation

PRODUCTION COSTS RELATIVE TO CROP YIELD



Solid red line:
Production cost depending on yield

Broken red line:
Yield and production costs for the example given in the tables

2nd cut grass silage is more expensive than 1st cut, but is still good value where yields exceed 2 t DM/ha (1 t DM/ac). Where you need the forage, second cuts are necessary, offering a second option for formulating the winter ration.

3RD CUT GRASS SILAGE

More expensive than 2nd cut. Ensure you need the forage, especially if you could make better use of grazed forage by keeping animals out longer or feeding less buffer in the summer.

Growing	
Fertiliser Refer to DEFRA's RB209 for more details	Utilise slurry and dirty water onto the 2nd cut aftermath as soon as possible after silaging, preferably by injection or using a trailing shoe. An additional 40-50 kg N/ha (32-40 units N/ac) inorganic fertiliser can be applied at this time, depending on slurry nutrients supplied. Applying up to 75 kg N/ha (60 units N/ha) may be more suitable where no muck has been applied.
Weeds	As for 2nd cut, aftermaths provide a good opportunity to get on top of weed burdens as the weed development is synchronised.

Harvesting	
Harvest date	Aim to cut the sward before it heads and loses nutritional quality.
Wilting	Be careful not to over wilt the crop, especially with light crops and hot weather

Ensiling	
Additive	3rd cut is often more mature, drier and less stable after the clamp is open. An additive that controls heating is most likely to be useful.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		Sow						Sow			
							Cut				

Typical Yield and Quality

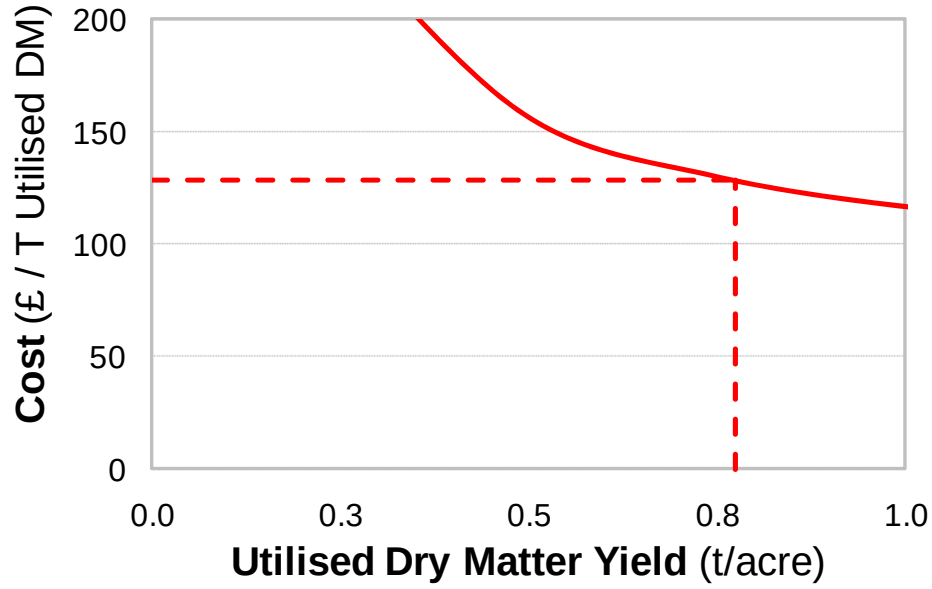
Fresh Yield	7 t/ha (3 t/ac)
Dry Matter	30%
Dry Matter Yield	2.2 t/ha (0.9 t/ac)
Percentage of dry matter that is utilised	87%
Utilised Dry Matter Yield	1.9 t/ha (0.8 t/ac)
Energy	10.8 MJ/KG DM
Crude Protein	14% in DM

Typical Cost & Value (5 year ley)

	Total Costs	Cash Costs[1]
Cost per Hectare	£246	£193
Cost per tonne fresh weight	£34	£26
Cost per tonne utilised dry matter	£128	£101
Cost per MJ of metabolisable energy	1.2p	0.9p
Cost per 100g of Crude Protein	9.2p	7.2p

[1]Establishment, variable and machinery costs, excluding rent and clamp depreciation

PRODUCTION COSTS RELATIVE TO CROP YIELD



Solid red line:
Production cost depending on yield

Broken red line:
Yield and production costs for the example given in the table

Some alternative bulk feeds may be cheaper than 3rd cut grass silage, A poor yielding 3rd cut is expensive, but it can be a useful management tool to aid grazing grass management.

ROUND BALE GRASS SILAGE (1ST CUT)

More expensive than 1st cut clamped silage but more flexible and less capital tied up in clamp space. Round bales undergo a limited fermentation, often maintaining high levels of sugars and not becoming overly acidic. This makes for a very palatable feed which is also a good source of long fibre. Lastly its flexibility of storage options makes it particularly suitable for out-wintered stock .

Growing	
Fertiliser	Fertilise as for conventional 1st cut. Refer to DEFRA's RB209 for more details on fertilisers

Harvesting	
Harvest date	As for clamped 1st cut, or as it fits in with the grazing.
Wilting	Target 35% DM as this gives firm bales and a limited fermentation.
Wrapping	Use a minimum of 4 layers of wrap. Increasing this to 6 layers will tend to reduce wastage and is especially useful where the dry matter is over 40% or the crop is particularly stalky. Wrap as soon as possible after baling.
Moving bales	Be very careful not to damage the wrap. Patch any holes immediately.

Storing	
Site	An accessible site is essential to make life easier in the winter. Ensue the surface is smooth to limit damage to the bales, away from water courses and not under trees.
Stacking	Stack a maximum of 3 high, then only if the bales are over 35% DM
Pests	Bait the site prior to clearing it for this year's silage as this maximises bait intake and vermin control. Net the stack to limit bird damage and bait it to deter rats.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		Sow					Sow				
				Cut							

Typical Yield and Quality

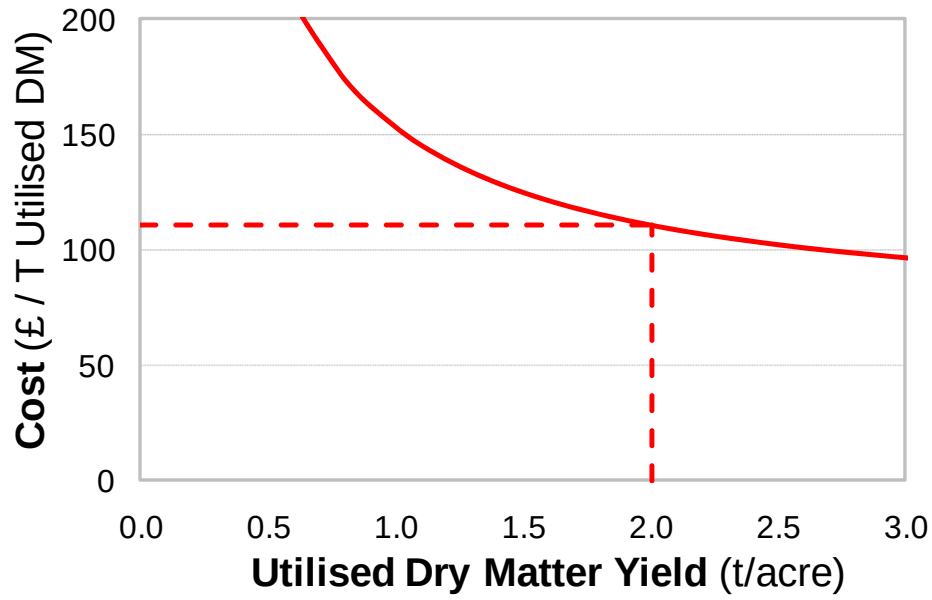
Fresh Yield	16.3 t/ha (6.6 t/ac)
Dry Matter	35%
Dry Matter Yield	5.7 t/ha (2.3 t/ac)
Percentage of dry matter that is utilised	87%
Utilised Dry Matter Yield	5.0 t/ha (2.0t/ac)
Energy	11.2 MJ/KG DM
Crude Protein	15% in DM

Typical Cost & Value (5 year ley)

	Total Costs	Cash Costs[1]
Cost per Hectare	£549	£444
Cost per tonne fresh weight	£34	£27
Cost per tonne utilised dry matter	£111	£90
Cost per MJ of metabolisable energy	1.0p	0.8p
Cost per 100g of Crude Protein	7.4p	6.0p

[1]Establishment, variable and machinery costs, excluding rent and clamp depreciation

PRODUCTION COSTS RELATIVE TO CROP YIELD



Solid red line:
Production cost depending on yield

Broken red line:
Yield and production costs for the example given in the tables

Take account of reduced capital invested in clamps when looking at the price.

ROUND BALE GRASS SILAGE (LATE 1ST CUT)

1st cut grass silage, taken later, gives a bulky lower quality forage. This can be perfect for beef cattle and where production levels do not dictate that the best quality forages are fed. This more mature forage is good for rumen health, though can be prone to heating at feed out if poorly consolidated.

Growing	
Fertiliser	Fertilise as for conventional 1st cut

Harvesting	
Harvest date	As for clamped late 1st cut.
Wilting	Target 35% DM as this gives firm bales and a limited fermentation.
Wrapping	Use a minimum of 4 layers of wrap. Increasing this to 6 layers will tend to reduce wastage and is especially useful where the dry matter is over 40% or the crop is particularly stalky. Wrap as soon as possible after baling.
Moving bales	Be very careful not to damage the wrap. Patch any holes immediately.

Storing	
Site	An accessible site is essential to make life easier in the winter. Ensue the surface is smooth to limit damage to the bales, away from water courses and not under trees.
Stacking	Stack a maximum of 3 high, then only if the bales are over 35% DM
Pests	Bait the site prior to clearing it for this year's silage as this maximises bait intake and vermin control. Net the stack to limit bird damage and bait it to deter rats.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		Sow					Sow				
					Cut						

Typical Yield and Quality

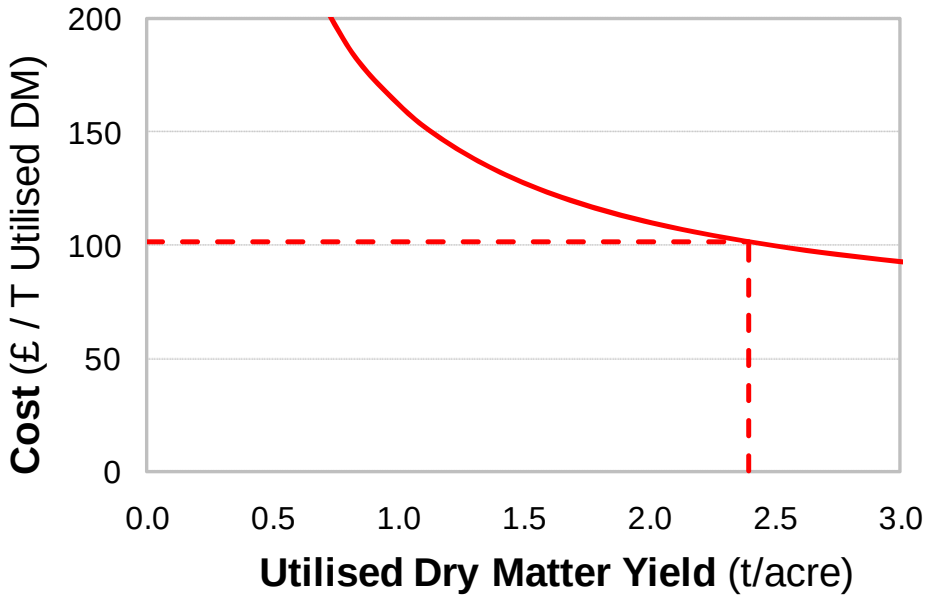
Fresh Yield	19 t/ha (8 t/ac)
Dry Matter	35%
Dry Matter Yield	6.8 t/ha (2.8 t/ac)
Percentage of dry matter that is utilised	87 %
Utilised Dry Matter Yield	5.9 t/ha (2.4 t/ac)
Energy	10.8 MJ/KG DM
Crude Protein	13% in DM

Typical Cost & Value (5 year ley)

	Total Costs	Cash Costs[1]
Cost per Hectare	£601	£462
Cost per tonne fresh weight	£31	£24
Cost per tonne utilised dry matter	£102	£78
Cost per MJ of metabolisable energy	0.9p	0.7p
Cost per 100g of Crude Protein	7.8p	6.0p

[1]Establishment, variable and machinery costs, excluding rent and clamp depreciation

PRODUCTION COSTS RELATIVE TO CROP YIELD



Solid red line:
Production cost depending on yield

Broken red line:
Yield and production costs for the example given in the tables

Take account of reduced capital invested in clamps when looking at the price.

ROUND BALE GRASS SILAGE (2ND CUT)

More expensive than 2nd cut clamped silage but much more flexible. Round bales should be valued as much for their good quality forage as for the flexibility they bring to managing grazing sward quality. Used in this way small areas can be baled before its quality diminishes, allowing the area to return with good quality young grass rather than over mature swards.

Round bales undergo a limited fermentation, often maintaining high levels of sugars and not becoming overly acidic. This makes for a very palatable feed which is also a good source of long fibre. Round bales are very handy for summer buffer feeding.
Lastly its flexibility of storage options makes it particularly suitable for out-wintered stock .

Growing	
Fertiliser	Fertilise as for conventional 2nd cut, or use to selectively take areas out of the grazing round if the grass is getting ahead of the stock. Refer to DEFRA's RB209 for more details on fertilisers

Harvesting	
Harvest date	As for clamped 2nd cut, or as it fits in with the grazing.
Wilting	Be careful not to over wilt the 2nd cut, especially if it has got a little over mature and the weather is very hot. Target 35% DM as this gives firm bales and a limited fermentation.
Wrapping	Use a minimum of 4 layers of wrap. Increasing this to 6 layers will tend to reduce wastage and is especially useful where the dry matter is over 40% or the crop is particularly stalky. Wrap as soon as possible after baling.
Moving bales	Be very careful not to damage the wrap. Patch any holes immediately.

Storing	
Site	An accessible site is essential to make life easier in the winter. Ensue the surface is smooth to limit damage to the bales, away from water courses and not under trees.
Stacking	Stack a maximum of 3 high, then only if the bales are over 35% DM
Pests	Bait the site prior to clearing it for this year's silage as this maximises bait intake and vermin control. Net the stack to limit bird damage and bait it to deter rats.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		Sow						Sow			
						Cut					

Typical Yield and Quality

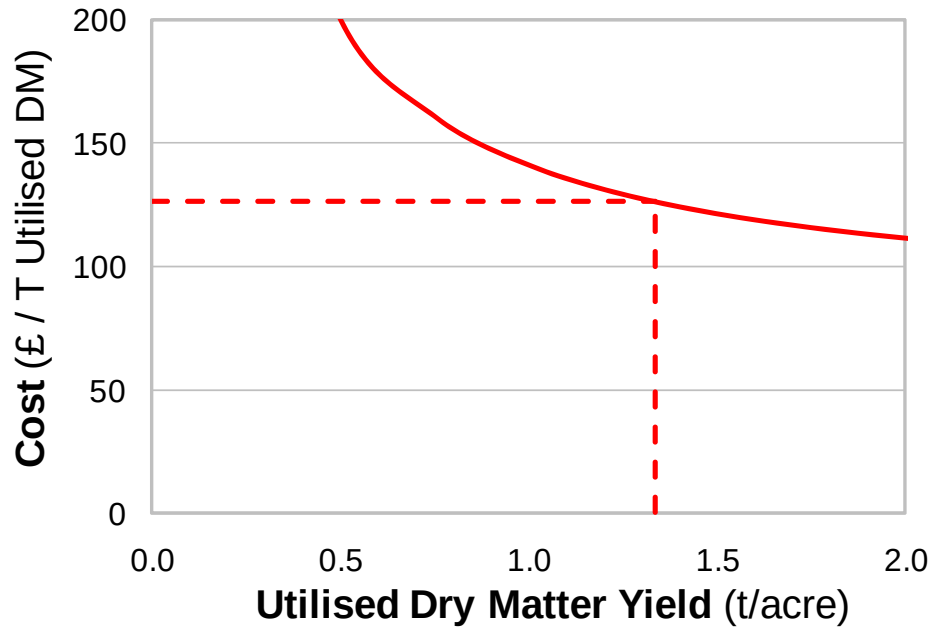
Fresh Yield	11 t/ha (4 t/ac)
Dry Matter	35%
Dry Matter Yield	3.8 t/ha (1.5 t/ac)
Percentage of dry matter that is utilised	87%
Utilised Dry Matter Yield	3.3 t/ha (1.3 t/ac)
Energy	10.8 MJ/KG DM
Crude Protein	14% in DM

Typical Cost & Value (5 year ley)

	Total Costs	Cash Costs[1]
Cost per Hectare	£417	£363
Cost per tonne fresh weight	£38	£33
Cost per tonne utilised dry matter	£126	£110
Cost per MJ of metabolisable energy	1.2p	1.0p
Cost per 100g of Crude Protein	9.0p	7.9p

[1]Establishment, variable and machinery costs, excluding rent and clamp depreciation

PRODUCTION COSTS RELATIVE TO CROP YIELD



Solid red line:
Production cost depending on yield

Broken red line:
Yield and production costs for the example given in the tables

Take account of the advantages to grass management when looking at the price.

ROUND BALE GRASS SILAGE (3RD CUT)

More expensive than 2nd cut. Ensure you need the forage, especially if you could make better use of grazed forage by keeping animals out longer or feeding less buffer in the summer.

Growing	
Fertiliser	Fertilise as for conventional 3rd cut, or use to selectively take areas out of the grazing round if the grass is getting ahead of the cows. Refer to DEFRA's RB209 for more details on fertilisers

Harvesting	
Harvest date	As for clamped 3rd cut, or as it fits in with the grazing.
Wilting	Be careful not to over wilt the 3rd cut, especially if it has got a little over mature and the weather is very hot. Target 35% DM as this gives firm bales and a limited fermentation.
Wrapping	Use a minimum of 4 layers of wrap. Increasing this to 6 layers will tend to reduce wastage and is especially useful where the dry matter is over 40% or the crop is particularly stalky. Wrap as soon as possible after baling.
Moving bales	Be very careful not to damage the wrap. Patch any holes immediately.

Storing	
Site	An accessible site is essential to make life easier in the winter. Ensue the surface is smooth to limit damage to the bales, away from water courses and not under trees.
Stacking	Stack a maximum of 3 high, then only if the bales are over 35% DM
Pests	Bait the site prior to clearing it for this year's silage as this maximises bait intake and vermin control. Net the stack to limit bird damage and bait it to deter rats.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		Sow						Sow			
							Cut				

Typical Yield and Quality

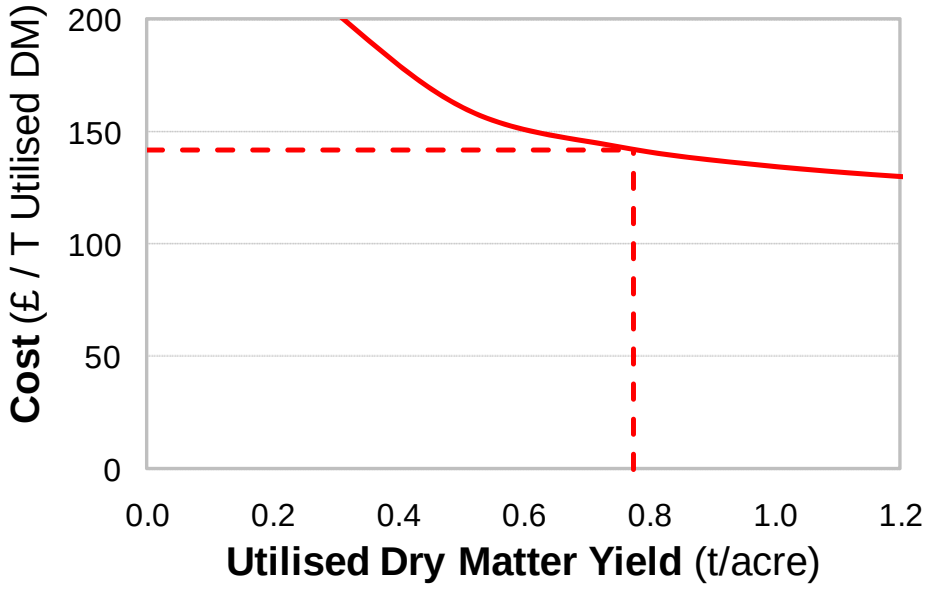
Fresh Yield	6.3 t/ha (2.5 t/ac)
Dry Matter	35%
Dry Matter Yield	2.2 t/ha (0.9 t/ac)
Percentage of dry matter that is utilised	87%
Utilised Dry Matter Yield	1.9 t/ha (0.8 t/ac)
Energy	10.8 MJ/KG DM
Crude Protein	14% in DM

Typical Cost & Value (5 year ley)

	Total Costs	Cash Costs[1]
Cost per Hectare	£272	£232
Cost per tonne fresh weight	£43	£37
Cost per tonne utilised dry matter	£142	£121
Cost per MJ of metabolisable energy	1.3p	1.1p
Cost per 100g of Crude Protein	10.2p	8.7p

[1]Establishment, variable and machinery costs, excluding rent and clamp depreciation

PRODUCTION COSTS RELATIVE TO CROP YIELD



Solid red line:
Production cost depending on yield

Broken red line:
Yield and production costs for the example given in the tables

Take account of the advantages to grass management when looking at the price.

ITALIAN RYEGRASS (3 SILAGE CUTS)

Italian ryegrass (IRG) is quick to establish and grows rapidly, making it an excellent cutting sward. Its life is shorter than the perennial ryegrass that makes up conventional grazing swards. The sward will tend to be quite open and is less suitable for grazing.

Establishment	
Timing	IRG can be spring or autumn sown but the best time to sow is in late summer or early autumn to produce high yields the following year
Sowing	Cultivate to achieve a fine, firm seedbed or direct drill into an existing sward or stubble. Drill at a depth of 12 mm (½") at a rate of 35 kg/ha (14 kg/ac)
Fertiliser	Check P & K status and adjust accordingly. 50-60 kg N /ha (40-48 units N/ac) may be incorporated into the seedbed. Be aware of NVZ limitations on spreading muck and fertiliser in the Autumn

Growing	
Soil pH	Soil acidity has a huge effect on grass production. Apply lime at a rate of 2.5 t/ha (1 t/ac) per year until the problem is resolved. Aim for a pH of 6.0 - 6.5
Fertiliser Refer to DEFRA's RB209 for more details	Apply slurry a minimum of 6 weeks before 1st cut unless injected or applied below the grass canopy with a trailing shoe. Use dirty water or slurry on the aftermaths to reduce the need for bagged N. Composted FYM is better than fresh FYM as it is less likely to be picked up in the next cut of silage. 1st cut will typically need 130 kg of N/ha (100 units N/ac) applied in a split dose, 40-60 kg N/ha (32-48 units/acre N) late February/early March, and the remainder a month later. 2nd and 3rd cuts will use about 75 kg N/ha (60 units/ac) and 50 kg/ha (40 units) of N each cut, respectively. Increase rates where no slurry is applied.

Harvesting	
Harvest date	Italian ryegrass will tend to be ready before your main perennial crop so ensure you can work this into your silaging workload. Leaving them to match in with perennials will result in them being over mature and poor quality. This can be a major drawback. 3 or 4 cuts can typically be taken.

Ensiling	
Additive	Follow good practice, see above

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		Sow						Sow			
			Cut		Cut			Cut			

Typical Yield and Quality

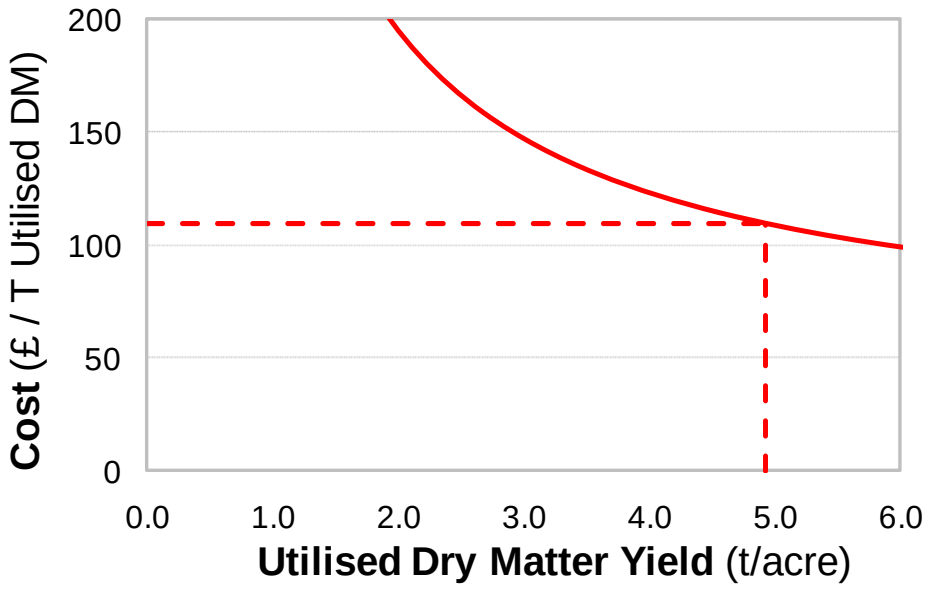
Fresh Yield	52 t/ha (21 t/ac)
Dry Matter	27%
Dry Matter Yield	14 t/ha (5.7 t/ac)
Percentage of dry matter that is utilised	87 %
Utilised Dry Matter Yield	12.2 t/ha (4.9 t/ac)
Energy	11 MJ/KG DM
Crude Protein	13% in DM

Typical Cost & Value (2 year ley)

	Total Costs	Cash Costs[1]
Cost per Hectare	£1,334	£1,024
Cost per tonne fresh weight	£26	£20
Cost per tonne utilised dry matter	£110	£84
Cost per MJ of metabolisable energy	1.0p	0.8p
Cost per 100g of Crude Protein	8.4p	6.5p

[1]Establishment, variable and machinery costs, excluding rent and clamp depreciation

PRODUCTION COSTS RELATIVE TO CROP YIELD



Solid red line:
Production cost depending on yield

Broken red line:
Yield and production costs for the example given in the tables

Italian ryegrass makes a great cutting sward however high yields are essential if swards are to be good value. Feed it well to get the best out of it.

ITALIAN RYEGRASS WITH RED CLOVER (3 SILAGE CUTS)

Italian ryegrass (IRG) is quick to establish, grows rapidly and makes an excellent cutting sward.
Adding red clover to the mix will increase the protein content of the silage as well as reducing the nitrogen requirement of the crop.
Establishing and maintaining a good balance of IRG and red clover can be difficult as one may dominate the other.
Grazing the aftermath is possible as modern red clover varieties tend to cause less bloat. Remember that the life of the IRG will be reduced if it is heavily grazed, especially by sheep. Also, be aware of the negative effects of flushing ewes on red clover, instead use it for lambs.
Leave 5 years before red clover is grown again in the same field.

Establishment	
Timing	IRG and red clover can be Spring or Autumn sown but the best time to sow is in late summer or early autumn to produce high yields the following year
Seed	Select a red clover variety with good persistence and disease resistance.
Sowing	Cultivate to achieve a fine, firm seedbed or direct drill into an existing sward or stubble.
Fertiliser	IRG and red clover seedlings benefit from a light dressing of N to aid establishment – typically 50-60 kg/ha N (40-50 units/ac) may be incorporated into the seedbed. Be aware of NVZ limitations on spreading muck and fertiliser in the Autumn. Check P & K status and adjust accordingly.

Growing	
Soil pH	Low soil pH will reduce the competitiveness of the red clover. Lime at a rate of 2.5 t/ha (1t/ac) to keep the soil pH at 6.5.
Fertiliser Refer to DEFRA's RB209 for more details	Apply slurry a minimum of 6 weeks before 1st cut unless injected or applied below the grass canopy with a trailing shoe. Use dirty water or slurry on the aftermaths to reduce the already low requirements for bagged N. IRG with Red clover will benefit from a light dose of N early in the year, before the clover produces much N. Apply about 40 kg of N /ha before 1st cut and possibly a half rate for 2nd cut, depending on clover levels.

Harvesting	
Harvest date	Italian ryegrass will tend to be ready before your main perennial crop so ensure you can work this into your silaging workload. Leaving them to match in with perennials will result in them being over mature, headed and be lower quality.
Wilting	Wilt to 25-30% DM to ensure the clover does not disrupt the fermentation. Be careful not to over wilt as this will lead to red clover leaf shatter and protein loss as well as heating at feed out.

Ensiling	
Additive	Red clover can make ensiling more difficult. If the crop has high red clover levels and cannot be effectively wilted then consider using an additive to help with the fermentation.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		Sow						Sow			
				Cut		Cut		Cut			

Typical Yield and Quality

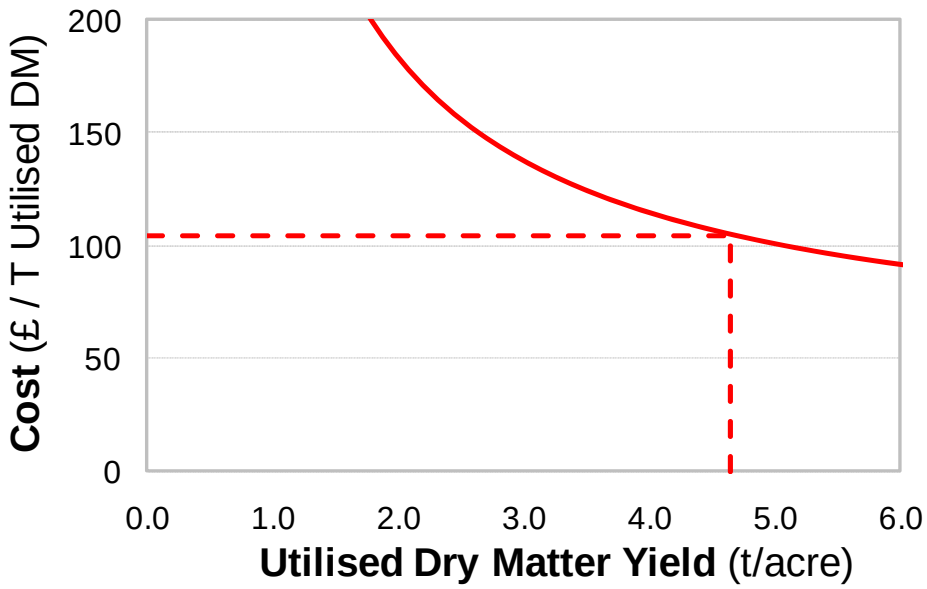
Fresh Yield	49 t/ha (20 t/ac)
Dry Matter	27%
Dry Matter Yield	13 t/ha (5.3 t/ac)
Percentage of dry matter that is utilised	87%
Utilised Dry Matter Yield	11.5 t/ha (4.6 t/ac)
Energy	10.8 MJ/KG DM
Crude Protein	17% in DM

Typical Cost & Value (2 year ley)

	Total Costs	Cash Costs[1]
Cost per Hectare	£1,202	£900
Cost per tonne fresh weight	£25	£18
Cost per tonne utilised dry matter	£105	£78
Cost per MJ of metabolisable energy	1.0p	0.7p
Cost per 100g of Crude Protein	6.2p	4.6p

[1]Establishment, variable and machinery costs, excluding rent and clamp depreciation

PRODUCTION COSTS RELATIVE TO CROP YIELD



Solid red line:
Production cost depending on yield

Broken red line:
Yield and production costs for the example given in the tables

Including red clover in short term cutting swards reduces costs and improves quality. Relative to buying in protein, this is definitely worth considering.

LUCERNE SILAGE (4 CUTS)

Lucerne is a high protein legume which can provide a good yield if grown under optimal conditions. Lucerne is deep rooted and particularly drought tolerant making it a valuable crop in dry summers. Lucerne also provides a nitrogen reserve for the following crop.

Establishment	
Soil	Soils must be deep, freely draining, compaction free and at no risk of waterlogging.
Seedbed	Resolve any compaction problems, then cultivate to achieve a fine, firm, moist seedbed. Correct soil to pH 6.2-7.8.
Sowing	May sowing will see the best establishment as soils need to be warm. The seed must be treated with a live Rhizobia meliloti inoculum before sowing to promote root nodulation. Sow at 20 kg/ha (8 kg/ac) at depth of 1.5 cm on clay soils and 2.5 cm on sandy soil and roll well.
Pests	Act promptly at the first sign of slug damage.
Fertiliser	25 kg/ha (20 units/ac) of nitrogen will be needed if the ground has been in cereals for a few years, otherwise no N is needed. Livestock manures and bagged P and K should be applied where the soil P index is 3 or lower and the K index is 2 or lower:

Growing	
Fertiliser Refer to DEFRA's RB209 for more details	Well established Lucerne crops will not require further nitrogen supply. P and K requirements are higher than those of grass so ensure the crop receives P and K according to soil indices for first and subsequent cuts:
Sprays	Spray for grass weeds during the winter dormancy growth stage

Harvesting	
Harvest	To achieve a 30% dry matter silage with the optimal compromise between yield and quality, harvest the crop at the mid to late bud stage, when the flowers are just beginning to develop colour. Avoid severe defoliation in the establishment year at all costs. Cut at 7.5 cm (3") to promote regrown. Use a conditioner mower and ted to achieve 30% dry matter for silage, or ted further and make hay.
Grazing	Very light grazings are possible, but be watchful for bloat issues.
Ensiling	
Additive	Use a product designed for working with low sugar crops.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
			Sow			Sow					
				Cut		Cut		Cut			

Typical Yield and Quality

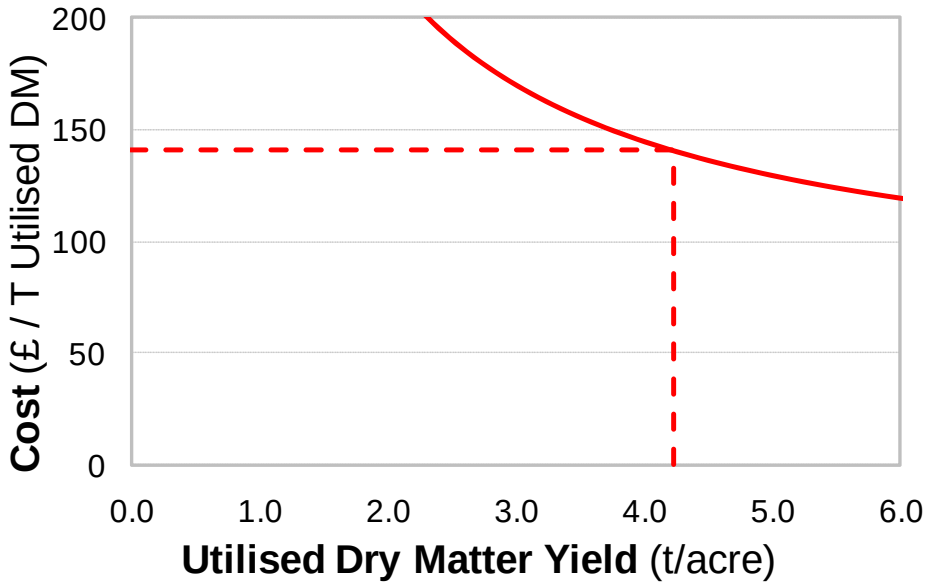
Fresh Yield	40 t/ha (16 t/ac)
Dry Matter	30%
Dry Matter Yield	12 t/ha (4.9 t/ac)
Percentage of dry matter that is utilised	87 %
Utilised Dry Matter Yield	10.4 t/ha (4.2 t/ac)
Energy	10 MJ/KG DM
Crude Protein	18% in DM

Typical Cost & Value (4 year ley)

	Total Costs	Cash Costs[1]
Cost per Hectare	£1,467	£1,150
Cost per tonne fresh weight	£37	£29
Cost per tonne utilised dry matter	£140	£110
Cost per MJ of metabolisable energy	1.4p	1.1p
Cost per 100g of Crude Protein	7.8p	6.1p

[1]Establishment, variable and machinery costs, excluding rent and clamp depreciation

PRODUCTION COSTS RELATIVE TO CROP YIELD



Solid red line:
Production cost depending on yield

Broken red line:
Yield and production costs for the example given in the tables

On the right ground Lucerne can provide a high protein forage. For many, the crop can prove problematic due to establishment difficulties and the fact that its cutting pattern is often not synchronised with grass silage making.

FORAGE PEAS

Forage peas are a quick growing, high protein crop that produces a highly palatable feed. Peas can fix up to 75 kg/ha of Nitrogen during the season. It is quite often mixed with barley or as part of an arable silage or unsown with grass.

Establishment	
Soil pH	Soil pH needs to be 6 or above. Peas suit most soil types that can create a moderate tilth, as long as they are free draining.
Sowing	Avoid soil compaction and having too fine a soil tilth. Sow in rows10 - 20 cm (4-8 inches) apart at a depth of 3 cm (1.5 inches). Drill at 125 kg seed/ha, broadcast at 150 kg/ha. Higher yields will be obtained from earlier sowing.
Seed selection	Choose varieties depending on sowing dates, resistance to lodging and whether it is going to be part of an arable silage mixed with spring barley or spring wheat.
Fertiliser	Peas will fix 75 kg/ha of nitrogen, yet a small dressing of NPK may be necessary. Peas can be sensitive to sulphur deficiency.
Pests	Watch out for bird damage from rooks and pigeons. Pea and bean weevil can also cause problems.

Growing	
Weeds	Peas grow vigorously so weeds are usually smothered, chick weed and weed grasses can be problems.
Pests	Pea aphid can cause problems

Harvesting	
Silage	11-14 weeks posts sowing when pods are formed but peas are only just beginning to develop. Wilt for 24-48 hours to ensure good DM content above 25%. Precision chopping is essential.
Grazing	Peas can be strip grazed providing intakes and wastage are controlled by a good quality electric fence.
Ensiling	A silage additive may be needed.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		Sow									
					Harvest/Graze						

Typical Yield and Quality

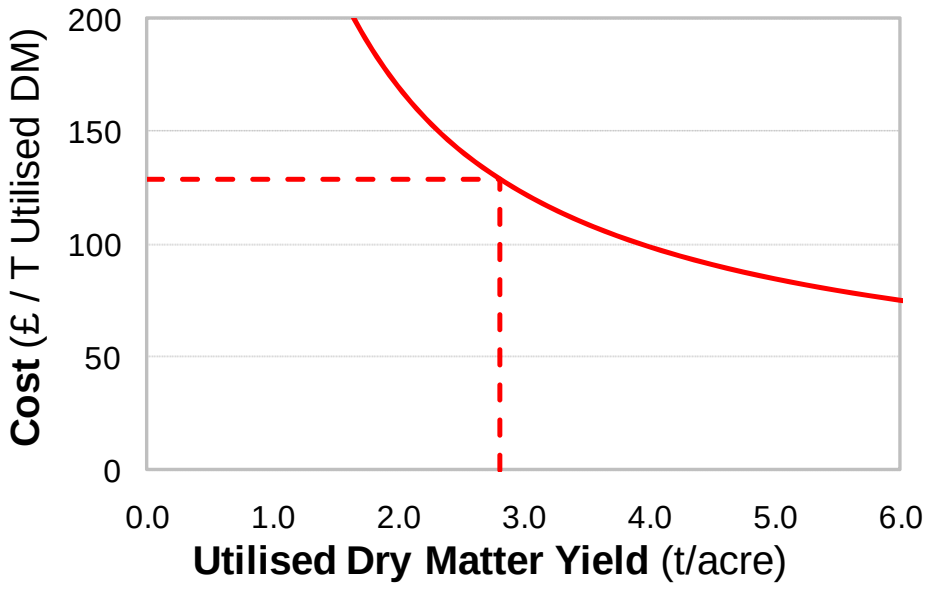
Fresh Yield	27 t/ha (11 t/ac)
Dry Matter	30%
Dry Matter Yield	8 t/ha (3.2 t/ac)
Percentage of dry matter that is utilised	87%
Utilised Dry Matter Yield	7.0 t/ha (2.8 t/ac)
Energy	9.9 MJ/KG DM
Crude Protein	17% in DM

Typical Cost & Value

	Total Costs	Cash Costs[1]
Cost per Hectare	£711	£520
Cost per tonne fresh weight	£27	£20
Cost per tonne utilised dry matter	£102	£75
Cost per MJ of metabolisable energy	1.0p	0.8p
Cost per 100g of Crude Protein	6.0p	4.4p

[1]Establishment, variable and machinery costs, excluding rent and clamp depreciation

PRODUCTION COSTS RELATIVE TO CROP YIELD



Solid red line:
Production cost depending on yield

Broken red line:
Yield and production costs for the example given in the tables

Excellent yields are required if it is to be more effective to grow rather than buy in protein. This crop fixes nitrogen which will be of benefit to the following crop and is often bicroppped with a cereal and under sown with grass.

FODDER BEET

This high energy, palatable and nutritious crop consistently yields more dry matter per acre than any other forage crop. For this reason it can offer a very good value feed.
Its main limitations are to do with harvesting late in the season and getting the crop clean enough to feed without the risk of soil contamination of the diet.

Establishment	
Timing	Sow late March to the end of April
Soil	Better on light or medium soils to avoid harvest problems in the Autumn. Target a pH of 7.0 Deep lift or subsoil to remove compaction
Sowing	Precision drill at 124,000 seeds/ha (50,000 seeds/ac) into a fine, firm seedbed.
Variety selection	Select varieties depending on whether you will be feeding in situ or lifting and clamping. Higher dry matter varieties tend to store better.
Fertiliser	Apply P and K in the Autumn, depending on indices. Sodium is also beneficial on many soil types. Nitrogen needs to be applied at drilling, allowing for muck and previous cropping.

Growing	
Weeds and pests	Effective weed control is critical so a good herbicide and insecticide regime must be designed for your circumstances.

Harvesting	
Harvest date	Lift in late Autumn, depending on ground conditions. Avoid the crop getting any frost damage. Early lifting will compromise yield but result in a cleaner crop.

Storage	
Clamping	Clamp and protect from frost.
Feeding	Wash prior to feeding (or clamping). Feeding in the field is possible, but utilization will be lower.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
			Sow								
									Harvest/Graze		

Typical Yield and Quality

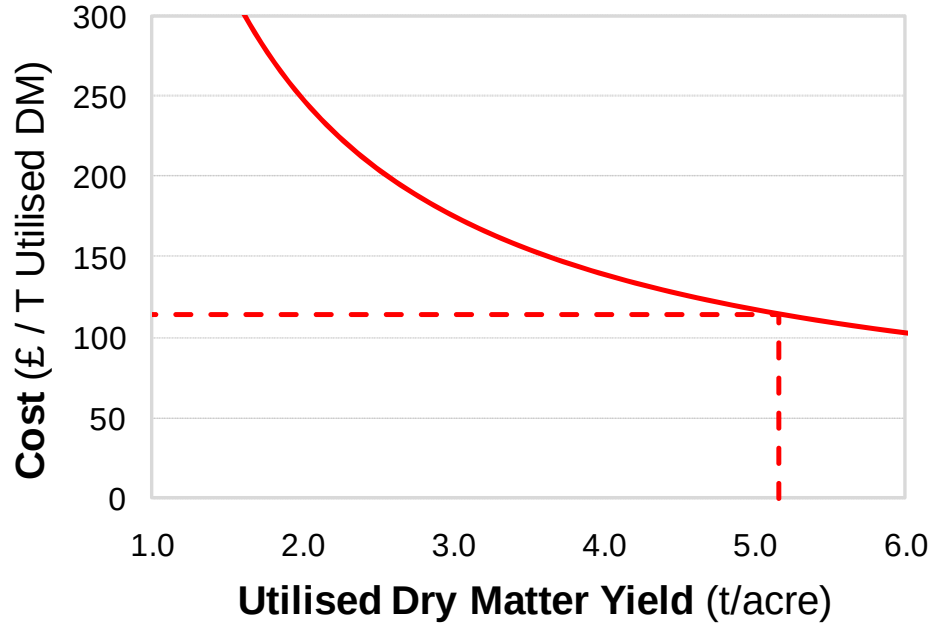
Fresh Yield	94 t/ha (38 t/ac)
Dry Matter	16%
Dry Matter Yield	15 t/ha (6.1 t/ac)
Percentage of dry matter that is utilised	85%
Utilised Dry Matter Yield	12.8 t/ha (5.2 t/ac)
Energy	13 MJ/KG DM
Crude Protein	13% in DM

Typical Cost & Value

	Total Costs	Cash Costs[1]
Cost per Hectare	£1,461	£1,014
Cost per tonne fresh weight	£16	£11
Cost per tonne utilised dry matter	£115	£80
Cost per MJ of metabolisable energy	0.9p	0.6p
Cost per 100g of Crude Protein	9.2p	6.4p

[1]Establishment, variable and machinery costs, excluding rent and clamp depreciation

PRODUCTION COSTS RELATIVE TO CROP YIELD



Solid red line:
Production cost depending on yield

Broken red line:
Yield and production costs for the example given in the tables

If you can overcome the challenges of harvesting and feeding Fodder Beet then this is a good value crop.

MAIZE SILAGE

For those in areas where a good maize crop can be consistently grown maize silage offers a good value, high starch crop. Success is most likely where a good quality seed bed is prepared and any areas of compaction are eliminated. Close attention to weed control will ensure the crop gets away well.
In marginal growing areas, where yields are consistently less than 10 t DM/ha (4.0 t/ac) at 25% starch, other options should be considered**.**

Establishment	
Site	Maize needs to be grown in an area where it will get sufficient heat units to mature. South facing fields with warm soils are favourable.
Soil pH	Test the soil and apply lime at a rate of 2.5 t/ha (1 t/ac) per year to remedy any problems. Aim for a pH of 6.2 - 6.5
Muck	Ploughing in FYM or Slurry will provide an excellent source of nutrients for the growing crop. Be aware of NVZ limitations.
Timing	Sow from mid April onwards, as soon as the soil temperature consistently reaches 8^{o}C at 5-6cm depth. It is vital to get seed in by mid May at the very latest.
Sowing	Cultivate to achieve a fine, firm seedbed, having removed all compaction. Sow at 104,000 – 124,000 seeds/ha (42-50,000 seeds/ac) at a depth of 5cm (2") into moisture. Only roll where the seed bed is very knobbly and dry.
Seed selection	Choose seed varieties to suit your site and expected harvest date. Where ground conditions can get difficult at harvesting consider growing earlier varieties.
Fertiliser Refer to DEFRA's RB209 for more details	Check P & K status. Maize responds well to P applied into the seed bed when drilling. Apply 125 kg/ha (100 units/ac) of MAP or DAP where the P index is 0 or 1, half rate for indices 2 or 3, and none above this level. Additional N inputs will depend on expected crop yield, muck applications and timing, previous cropping etc. A typical 42 t FM/ha (17t/ac) maize crop will need total N inputs of around 138 kg/ha (112 units/ac) of N, applied before the three leaf stage.

Growing	
Weeds	Weeds are a major problem for maize crops. Crops that are challenged by weeds rarely recover fully. An effective spray programme is essential to maximise yields and grow cost effective maize. Select a combination of products to cover the main weed challenge. Ensure you apply them in good time.

Harvesting	
Harvest date	Harvest from mid Sept – Oct depending on location, growing season and variety sown. Target 30 – 35% dry matter.
Chop length	1-2cm, depending on dry matter and make-up of the diet.

Ensiling	
Additive	Maize will readily ferment without an additive, but additives can be useful to control heating at feed out.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
			Sow								
								Harvest			

Typical Yield and Quality

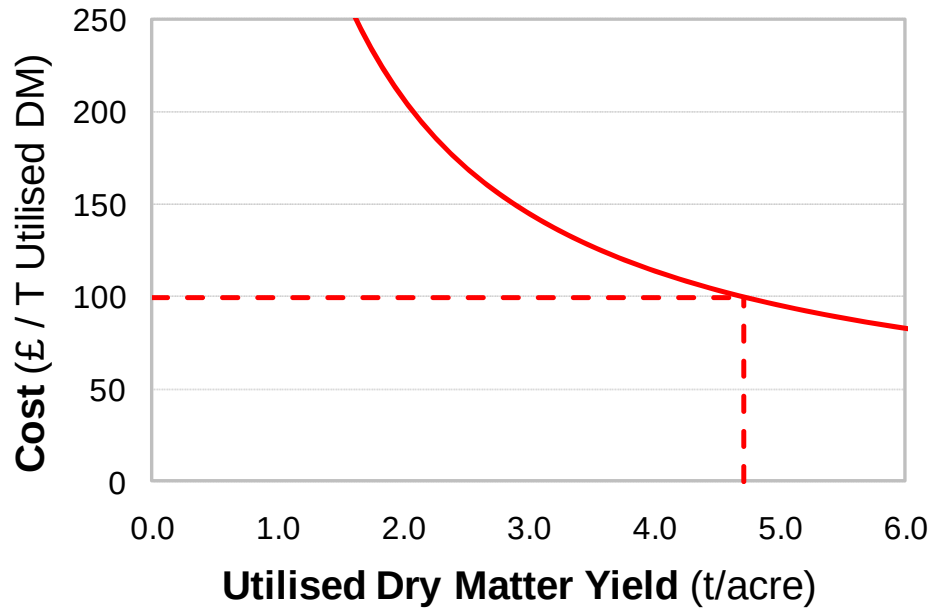
Fresh Yield	42 t/ha (17 t/ac)
Dry Matter	32%
Dry Matter Yield	13.4 t/ha (5.4 t/ac)
Percentage of dry matter that is utilised	87%
Utilised Dry Matter Yield	11.7 t/ha (4.7 t/ac)
Energy	11.2 MJ/KG DM
Crude Protein	9% in DM

Typical Cost & Value

	Total Costs	Cash Costs[1]
Cost per Hectare	£1,160	£839
Cost per tonne fresh weight	£28	£20
Cost per tonne utilised dry matter	£100	£72
Cost per MJ of metabolisable energy	0.9p	0.6p
Cost per 100g of Crude Protein	11.1p	8.0p

[1]Establishment, variable and machinery costs, excluding rent and clamp depreciation

PRODUCTION COSTS RELATIVE TO CROP YIELD



Solid red line:
Production cost depending on yield

Broken red line:
Yield and production costs for the example given in the tables

In mainstream growing areas, forage maize remains a good value feed, however on very poor growing sites, consider alternative starch sources.

MAIZE UNDER PLASTIC FOR SILAGE

Maize under plastic offers another option for farmers in marginal areas. The plastic allows the crop to be planted and harvested earlier for areas where frost and wet ground are problems or where another crop is to be drilled after the maize. Establishment costs are high, with drilling costing about £100/acre, yet some cost is saved by not using any starter fertiliser.

Establishment	
Site	Not as critical as the plastic warms the soil allowing germination.
Soil pH	Test the soil and apply lime at a rate of 2.5 t/ha (1 t/ac) per year to remedy any problems. Aim for a pH of 6.2 - 6.5.
Muck	Ploughing in FYM or Slurry will provide an excellent source of nutrients for the growing crop. Be aware of NVZ limitations.
Timing	Mid March - mid April to maximise the chance to harvest early in the autumn.
Sowing	Cultivate to achieve a fine, firm seedbed, having removed all compaction. Sow at 94,000 -104,000 seeds/ha (38-42,000 seeds/ac) at a depth of 5 cm (2") into moisture.
Seed selection	Choose seed varieties proven under plastic as some varieties may struggle to break though the plastic.
Fertiliser Refer to DEFRA's RB209 for more details	Check P & K status. Starter fertiliser cannot be drilled with plastic so fertiliser should be incorporated before drilling. Additional N inputs will depend on expected crop yield, muck applications and timing, previous cropping etc. A typical 42 t/ha (17 t/ac) maize crop will need total N inputs of around 138 kg/ha (112 units/ac of N), applied before the three leaf stage.
Sprays	Pre emergence spray needs to be applied when drilling as the plastic encourages weeds as well as the maize. Post emergence spraying is difficult, so later flushes of weeds can be challenging.

Harvesting	
Harvest date	Harvest from Sept – Oct depending on location, growing season and variety sown. Target 30 – 35% dry matter.
Chop length	1-2 cm, depending on dry matter and make-up of the diet.

Ensiling	
Additive	Maize will readily ferment without an additive, but additives can be useful to control heating at feed out.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		Sow									
								Harvest			

Typical Yield and Quality

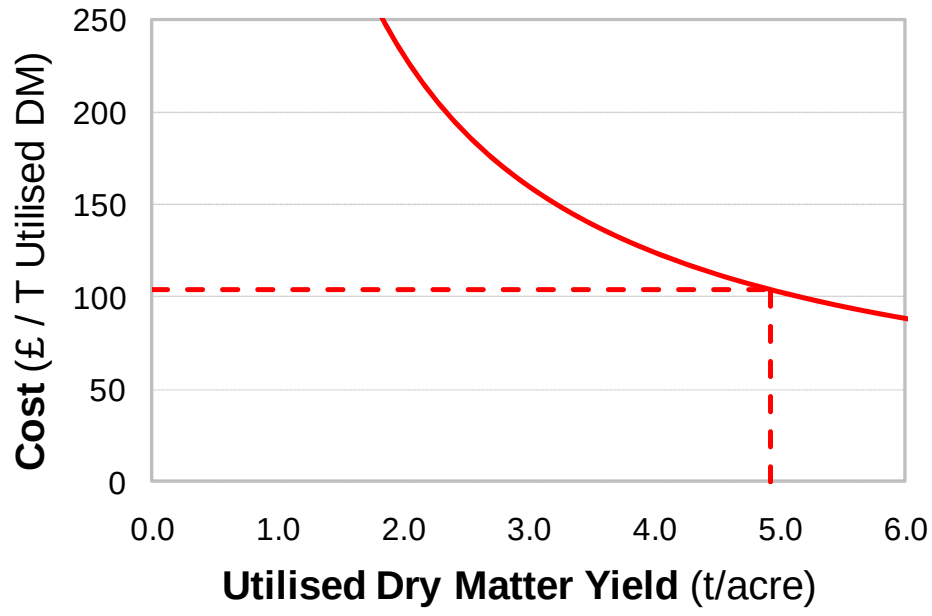
Fresh Yield	44 t/ha (18 t/ac)
Dry Matter	32%
Dry Matter Yield	14 t/ha (5.7 t/ac)
Percentage of dry matter that is utilised	87%
Utilised Dry Matter Yield	12.2 t/ha (4.9 t/ac)
Energy	11.2 MJ/KG DM
Crude Protein	9% in DM

Typical Cost & Value

	Total Costs	Cash Costs[1]
Cost per Hectare	£1,261	£993
Cost per tonne fresh weight	£29	£23
Cost per tonne utilised dry matter	£103	£82
Cost per MJ of metabolisable energy	0.9p	0.7p
Cost per 100g of Crude Protein	11.5p	9.1p

[1]Establishment, variable and machinery costs, excluding rent and clamp depreciation

Production Costs Relative to Crop Yield



Solid red line:
Production cost depending on yield

Broken red line:
Yield and production costs for the example given in the tables

Growing maize under plastic allows the crop to be grown in areas where it would not previously be viable to do so. Excellent weed control and high yields are essential to making maize under plastic a good option.

WHOLE CROP SILAGE

Fermented whole crop is a good value crop, offering a starch rich silage with many harvest options. Cutting date is a compromise between later cut crops having higher starch levels but being more difficult to conserve and feed effectively. The harder the grains get, the more tend to pass through the cow undigested.
Early cutting can fit into cropping rotations and ease workloads later in the season. Cost effective crops are grown where the best yields are achieved. This requires attention to detail and good use of inputs.

Establishment	
Timing	Winter wheat's are likely to give the best whole crop yields so aim to sow late September - November.
Sowing	Cultivate to achieve a moderately coarse seedbed. Sow at around 200 kg seed/ha (80 kg/ac).
Variety selection	Select high yielding varieties to suit your conditions.

Growing	
Soil pH	Keep soil pH above 6.0
Fertiliser	Fertiliser requirements will vary widely but a typical fertiliser N allowance is 150 kg N/ha (20 units N/ac) Refer to DEFRA's RB209 for more details and be aware of the optimum growth stages to apply the fertiliser.
Sprays	An effective spray regime needs to be matched to the conditions on your farm. Consult an agronomist and apply products at the right times or risk compromising yield.

Harvesting	
Harvest date	Harvest at the soft cheddar stage, at about 40% dry matter to get reasonable starch levels without making conserving and feeding difficult.
Cutting height	Stubble height can be increased to make a more concentrated forage.

Ensiling	
Additive	Consolidating whole crop is difficult so apply an additive where heating will be a problem.
Clamping	Fill in thin layers and roll, roll and roll some more. Sheeting as soon as possible and ensure a good seal Ideally, cap the top of the clamp with grass silage Round baling whole crop is an option, though ensure sufficient layers of wrap to avoid penetration by the straw.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
								Sow			
						Harvest					

Typical Yield and Quality

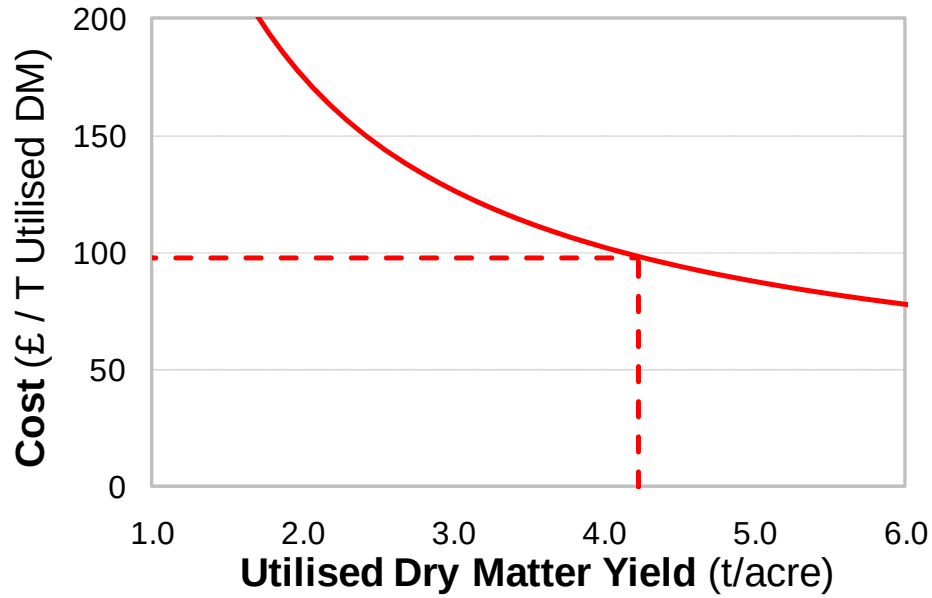
Fresh Yield	30 t/ha (12 t/ac)
Dry Matter	40%
Dry Matter Yield	12 t/ha (4.9 t/ac)
Percentage of dry matter that is utilised	87%
Utilised Dry Matter Yield	10.4 t/ha (4.2 t/ac)
Energy	10.4 MJ/KG DM
Crude Protein	10% in DM

Typical Cost & Value

	Total Costs	Cash Costs[1]
Cost per Hectare	£1,022	£729
Cost per tonne fresh weight	£34	£24
Cost per tonne utilised dry matter	£98	£70
Cost per MJ of metabolisable energy	0.9p	0.7p
Cost per 100g of Crude Protein	9.8p	7.0p

[1]Establishment, variable and machinery costs, excluding rent and clamp depreciation

GRAZED GRASS PRODUCTION COSTS RELATIVE TO CROP YIELD



Solid red line:
Production cost depending on yield

Broken red line:
Yield and production costs for the example given in the tables

Where quality maize cannot be grown whole crop is a good alternative, offering greater flexibility. Top quality agronomy is needed to ensure the best yields and a cost effective crop.

ALKALAGE

Alkalage is a urea preserved alkaline forage quite unlike other preserved forages. The best crops are made with very well grown winter wheat, harvested just before conventional harvest time. 'Home n Dry' is applied in the clamp and produces ammonia gas. The gas permeates the crop, inhibiting yeast and moulds and increasing the digestibility of the straw. Because of the urea inclusion the protein level of the forage is increased.

Establishment	
	See page the Whole Crop Silage section for establishment details

Growing	
Sprays	Weeds will tend to stay green whilst the corn is drying. These pockets of green material can ferment within the clamp disturbing the alkaline preservation. Because of this it is important to pay attention to weed challenges and spray accordingly.

Harvesting	
Harvest date	Harvest at around 70-80% dry matter at the hard grains to grains loosening stage.
Cutting height	Standard stubble height unless a more concentrated forage is required, in which case raise the cutting height
Processing	The crop needs to be harvested with a forage harvester equipped with a processor mill. This will ensue the grains are properly broken. If this is not achieved then substantial quantities of grain will pass through the cow.

Ensiling	
Additive	Apply 'Home n Dry' pellets at 35 – 40 kg/tonne. Spread using a fertiliser spinner or mix in with a loader before the forage is pushed and rolled into the clamp.
Sheeting	Sheet as soon as possible and ensure a good seal, including under lapping the side sheets to prevent gas escape.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
								Sow			
						Harvest					

Typical Yield and Quality

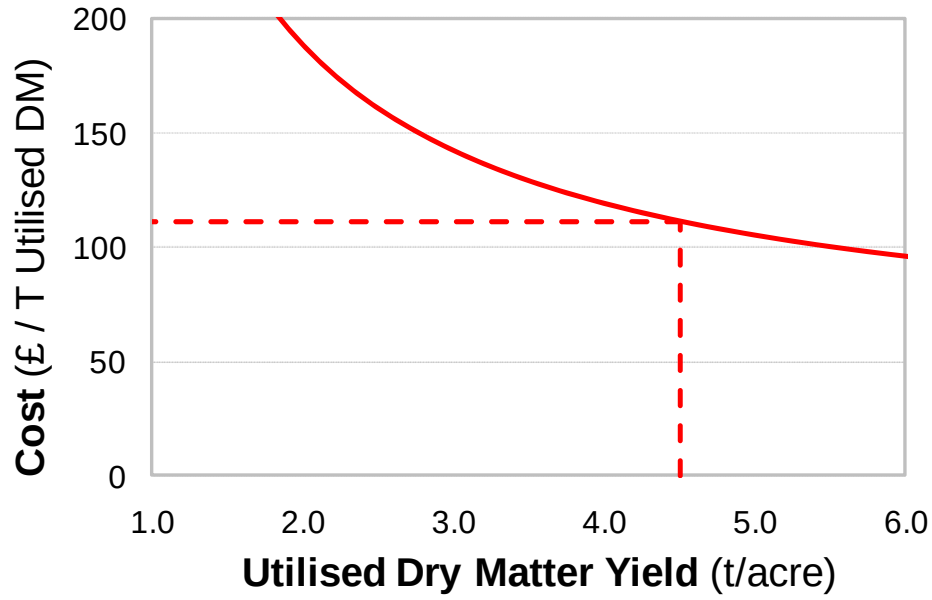
Fresh Yield	17 t/ha (7 t/ac)
Dry Matter	75%
Dry Matter Yield	12.8 t/ha (5.2 t/ac)
Percentage of dry matter that is utilised	87%
Utilised Dry Matter Yield	11.1 t/ha (4.5 t/ac)
Energy	11.0 MJ/KG DM
Crude Protein	17% in DM

Typical Cost & Value

	Total Costs	Cash Costs[1]
Cost per Hectare	£1,241	£979
Cost per tonne fresh weight	£73	£57
Cost per tonne utilised dry matter	£111	£88
Cost per MJ of metabolisable energy	1.0p	0.8p
Cost per 100g of Crude Protein	6.6p	5.2p

[1]Establishment, variable and machinery costs, excluding rent and clamp depreciation

PRODUCTION COSTS RELATIVE TO CROP YIELD



Solid red line:
Production cost depending on yield

Broken red line:
Yield and production costs for the example given in the tables

A valuable feed, providing a high starch forage with good crude protein levels. Ensure the crop is properly processed and the additive applied evenly. Allow for the degradable protein when formulating the diet.

CRIMPED WHEAT

Crimping wheat, rather than harvesting it conventionally, means that you get a highly digestible feed out of the field before the main cereal crop is ready. This can make management easier as well as giving a good starch source for the winter.

Establishment and Growing	
	Establish and grow as a good quality winter wheat (see the Whole Crop Silage section for establishment details)

Harvesting and Crimping	
Harvest date	Harvest when the grain is at 60% dry matter, at the hard cheddar stage.
Crimping	Crimp and apply an additive as soon as possible after harvest. An additive is needed to stop the grains heating. If this occurs very high levels of wastage can occur.
Straw	Straw can be baled, though it may require some drying first.

Clamping	
Clamping	Fill in thin layers and roll lightly, e.g. with a quad bike. Sheet well and ensure a good seal.
Rodents	Crimped grain is bed and breakfast for rodents. The clamp will need to be very effectively baited to keep rodents away.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
								Sow			
						Harvest					

Typical Yield and Quality

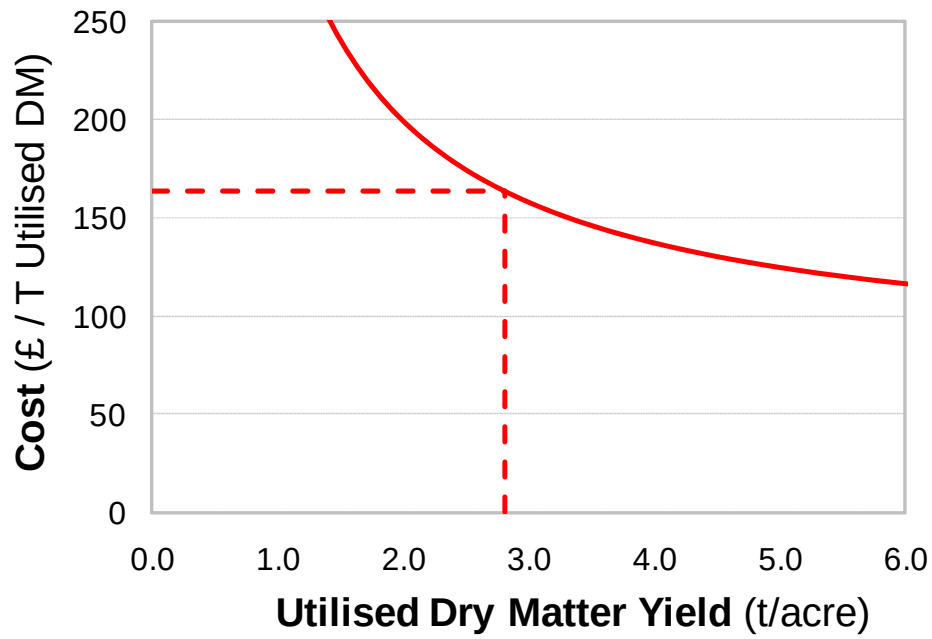
Fresh Yield	13 t/ha (5 t/ac)
Dry Matter	60%
Dry Matter Yield	8 t/ha (3.2 t/ac)
Percentage of dry matter that is utilised	87%
Utilised Dry Matter Yield	7.0 t/ha (2.8 t/ac)
Energy	13.0 MJ/KG DM
Crude Protein	10% in DM

Typical Cost & Value

	Total Costs	Cash Costs[1]
Cost per Hectare	£1,138	£914
Cost per tonne fresh weight	£85	£69
Cost per tonne utilised dry matter	£163	£131
Cost per MJ of metabolisable energy	1.3p	1.0p
Cost per 100g of Crude Protein	16.3p	13.1p

[1]Establishment, variable and machinery costs, excluding rent and clamp depreciation

PRODUCTION COSTS RELATIVE TO CROP YIELD



Solid red line:
Production cost depending on yield

Broken red line:
Yield and production costs for the example given in the tables

The cost effectiveness of crimping is strongly linked to the wheat market and the price of concentrates.

GRAIN MAIZE

Grain maize is gaining popularity as a high yielding source of energy with good levels of bypass starch. Optimum growing conditions are needed to maximise yields as well as land that is accessible late in the season.

Establishment and Growing	
Timing	Grow as for a conventional maize crop (see Maize Silage pages), using varieties that are appropriate for grain maize.

Harvesting	
Harvest date	Harvest at 65-70% dry matter, usually between late October and December.
Machine	Harvest the crop, leaving a mat of shredded maize stem behind. This improves the carrying capacity of the ground late in the season.
Crimping	Crimp and apply an additive as soon as possible after harvest to stop the grains heating. If this occurs very high levels of wastage can occur.

Ensiling	
Clamping	Fill in thin layers and roll lightly with a quad etc. Sheet well and ensure a good seal.
Rodents	Crimped maize grain is bed and breakfast for rodents. The clamp will need to be very effectively baited to keep rodents away.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
			Sow								
									Harvest		

Typical Yield and Quality

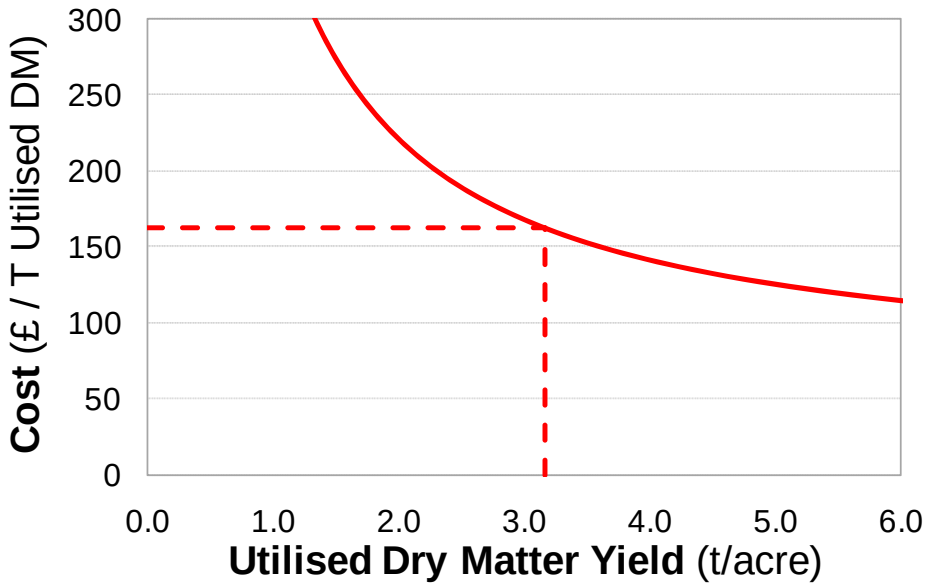
Fresh Yield	13 t/ha (5 t/ac)
Dry Matter	70%
Dry Matter Yield	9 t/ha (3.6 t/ac)
Percentage of dry matter that is utilised	87%
Utilised Dry Matter Yield	7.8 t/ha (3.2 t/ac)
Energy	14 MJ/KG DM
Crude Protein	10% in DM

Typical Cost & Value

	Total Costs	Cash Costs[1]
Cost per Hectare	£1,271	£1,019
Cost per tonne fresh weight	£99	£79
Cost per tonne utilised dry matter	£162	£130
Cost per MJ of metabolisable energy	1.2p	0.9p
Cost per 100g of Crude Protein	16.2p	13.0p

[1]Establishment, variable and machinery costs, excluding rent and clamp depreciation

PRODUCTION COSTS RELATIVE TO CROP YIELD



Solid red line:
Production cost depending on yield

Broken red line:
Yield and production costs for the example given in the tables

Make sure the ration is set up to take advantage of maize starch as wheat is a cheaper source of ME.

COMBINABLE PEAS

This can be an attractive crop to grow as animal feed due to its high protein content (25%).It is an excellent break crop in a cereal rotation and as a legume its nitrogen fixation properties leave residual nitrogen in the ground for the following crop. Unfortunately the crop is extremely susceptible to logging, resulting in harvesting difficulties and yield loses.

Establishment	
Timing	Peas should be drilled in spring as soon as temperatures exceed 5 degrees, from mid February onwards. Drilling should commence before mid April to avoid yield losses.
Sowing	Cultivate to produce a firm, fine seedbed. Seedbed compaction and wet conditions should be avoided when drilling the crop. Depending on variety selection seed rate should be between 65-95 plants/m². Drilled at 4-5 cm deep in 15 cm rows.
Variety Selection.	Select a variety depending on required end use and to suit ground conditions. Later maturing varieties should not be grown in cooler wetter areas in the country. Taller varieties are better suited to dry less fertile soils, whereas shorter varieties are better for fertile, moist soils.
Rotation	A 1 year in 5 rotation is ideal from for diseases control.

Growing	
Soil pH	Keep soil pH at 5.9-6.5.
Fertiliser	Fertiliser requirements will vary widely depending on soil indices. For an average yield no nitrogen is required and the crop needs about 35 kg P/ha (28.units P/ac) and 30 kg K/ha (24 units K/ac).
Sprays	Peas are not a competitive crop and spray costs can be high. Consult an agronomist for specific products, timing and rates.

Harvest	
Harvest Date	The harvest period will be dictated by the drilling date, location and weather, but will be between July for early varieties and early September for later varieties. Ideally combine at 16% to 20% moisture and dry to 14% DM. Crop should be combined 10 days after bottom pods turn brown, middle pods yellow and are top pods green.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Sow	Sow	Sow								
						Harvest	Harvest	Harvest			

Typical Yield and Quality

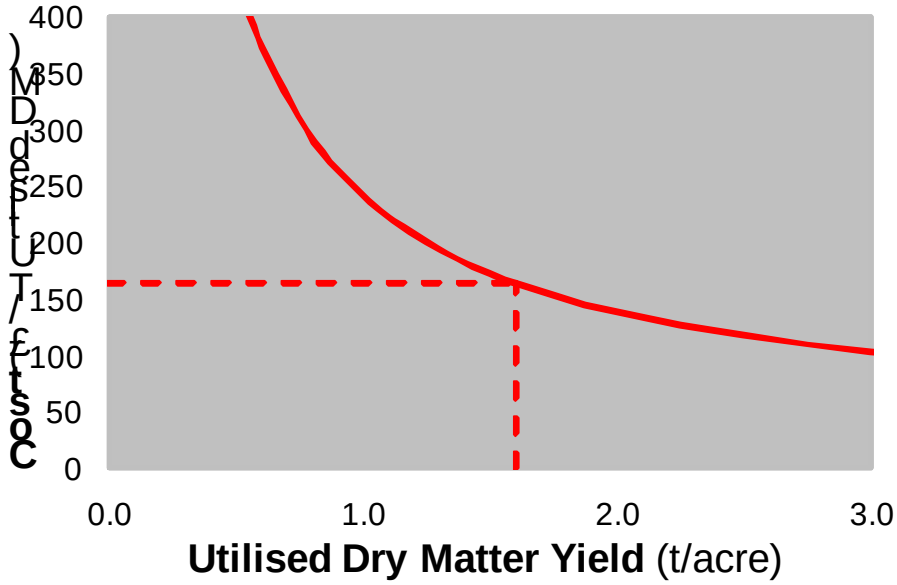
Fresh Yield	5 t/ha (2.1 t/ac)
Dry Matter	86%
Dry Matter Yield	4.4 t/ha (1.8 t/ac)
Percentage of dry matter that is utilised	90%
Utilised Dry Matter Yield	4.0 t/ha (1.6 t/ac)
Energy	13.5 MJ/KG DM
Crude Protein	25% in DM

Typical Cost & Value

	Total Costs	Cash Costs[1]
Cost per Hectare	£643	£493
Cost per tonne fresh weight	£126	£96
Cost per tonne utilised dry matter	£162	£124
Cost per MJ of metabolisable energy	1.2p	0.9p
Cost per 100g of Crude Protein	6.5p	5.0p

[1]Establishment, variable and machinery costs, excluding rent and clamp depreciation

PRODUCTION COSTS RELATIVE TO CROP YIELD



Solid red line:
Production cost depending on yield

Broken red line:
Yield and production costs for the example given in the tables

A well grown crop of combinable peas can be cost effective on the right soil type.

FIELD BEANS

Field beans are predominately grown to combine as high value protein feed and to act as a nitrogen fixing break crop. It is a popular choice within an arable rotation as it helps to control weeds and soil borne disease for the following crop in the rotation.

Establishment

Timing	Winter beans do best on heavier soils where water availability is not an issue. Beans should not be grown in very light soils where water retention is low. Winter bean establishment should be 4 weeks before frosts are likely to be an issue. Spring beans should be drilled as soon as temperatures exceed 5 degrees from mid February onwards. Drilling after mid March will dramatically reduce yield.
Sowing	Winter beans may be ploughed-in or broadcast on a ploughed field and then covered by harrowing. Spring beans are usually drilled at up to 7.5cm depth. Optimum plant population is between 50-60 plants m/². Shorter varieties should be drilled at 15 cm rows, taller varieties at 35 cm rows.
Variety selection	Shorter varieties should be selected for heavier soils where as taller varieties are suited to lighter soils more prone to drier conditions. Shorter varieties are more susceptible to the disease bean rust. Autumn sown varieties provide a higher yield but lower quality than spring alternatives.
Rotation	Beans should not be grown more frequently than 1 year in 6 due to the risk of soil borne diseases.

Growing

Soil pH	Keep soil pH is 6.8-7.
Fertiliser	Little or no nitrogen is required. Phosphate: 35 kg P/ha (28.units P/ac). Potash: 30 kg K/ha (24 units K/ac).
Sprays	Beans are not a competitive crop due to their low crop density and open canopy. It is important to control competitive weeds, e.g. fat hen, clever and volunteer rape as they can cause problems when combining. Diseases associated with the crop are rust, chocolate spot and pod/leaf spot. Pests include bean aphids, stem nematode and bean weevil. Consult an agronomist for specific products, timing and rates.

Harvesting

Harvest Date	Harvest when moisture content is below 20% and pods are black and brittle, usually in September.
Typical yield	Average yield expected would be 3.5 t/ha.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Drill									Drill	
								Harvest			

Typical Yield and Quality

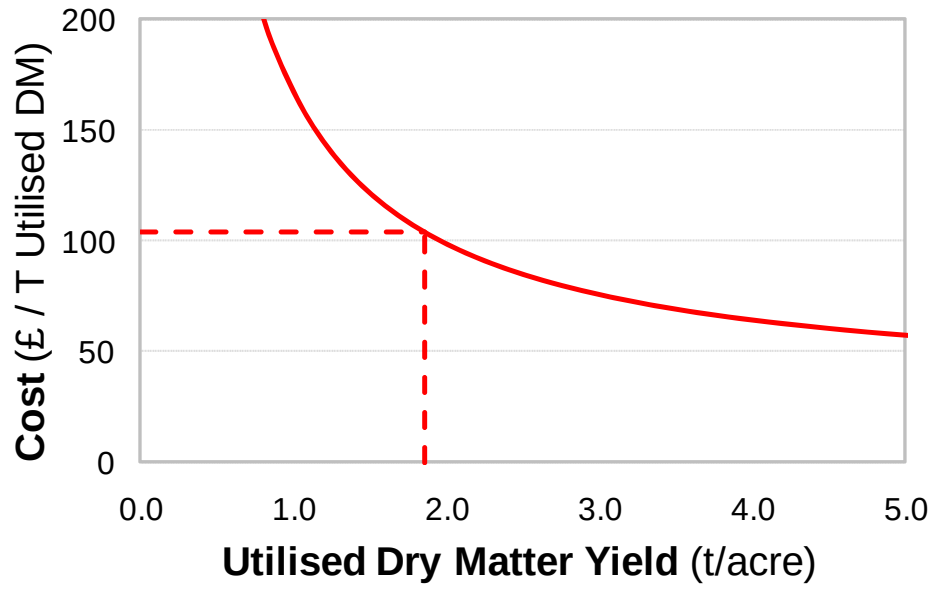
Fresh Yield	8 t/ha (3.3 t/ac)
Dry Matter	86%
Dry Matter Yield	7 t/ha (2.8 t/ac)
Percentage of dry matter that is utilised	90%
Utilised Dry Matter Yield	6.3 t/ha (2.5 t/ac)
Energy	14.8 MJ/KG DM
Crude Protein	36% in DM

Typical Cost & Value (winter beans)

	Total Costs	Cash Costs[1]
Cost per Hectare	£638	£433
Cost per tonne fresh weight	£78	£53
Cost per tonne utilised dry matter	£101	£69
Cost per MJ of metabolisable energy	0.7p	0.5p
Cost per 100g of Crude Protein	2.8p	1.9p

[1]Establishment, variable and machinery costs, excluding rent and clamp depreciation

PRODUCTION COSTS RELATIVE TO CROP YIELD



Solid red line:
Production cost depending on yield

Broken red line:
Yield and production costs for the example given in the tables

A good protein source for more arable minded farmers on heavier ground

LUPINS

Lupins can provide good levels of protein which can replace soya in the ration. It is a legume, which grows better in more acidic soils. Yields can be variable in most UK conditions. Spring lupins tend to produce the most reliable yield.

Establishment	
Timing	Late March is the optimal time for drilling to avoid a late harvested crop
Sowing	Cultivate to produce a firm, fine and moist seedbed. Sow at around 55kg/ac (130kg/ha). Use a rhizobium inoculant if lupins have not previously been grown.
Variety selection	Carefully select varieties to suit local conditions. Blue and white varieties tend to outperform yellow varieties.

Growing	
Soil pH	Keep soil pH between 5.0 and 6.5
Fertiliser	Fertiliser requirements will vary widely but a typical fertiliser allowance is: Nitrogen: 15 kg N/ha (12 units N/ac) Phosphate: 72 kg P/ha (58 units P/ac). Potash: 72 kg K/ha (58 units K/ac).
Sprays	Lupins are not a competitive crop and spray costs can be high. Consult an agronomist for specific products, timing and rates.

Harvesting	
Harvest date	The harvest period will be dictated by the drilling date, location and weather. The seed can be crimped at 30% moisture or harvested dry at 13% to 15% moisture. Harvesting can run into October, pre harvest glyphosate can help the ripening process.
Typical yield	Yields are very variable and usually range between 2 and 4 t/ha (0.8 and 1.6 t/ac).

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		Sow									
								Harvest			

Typical Yield and Quality

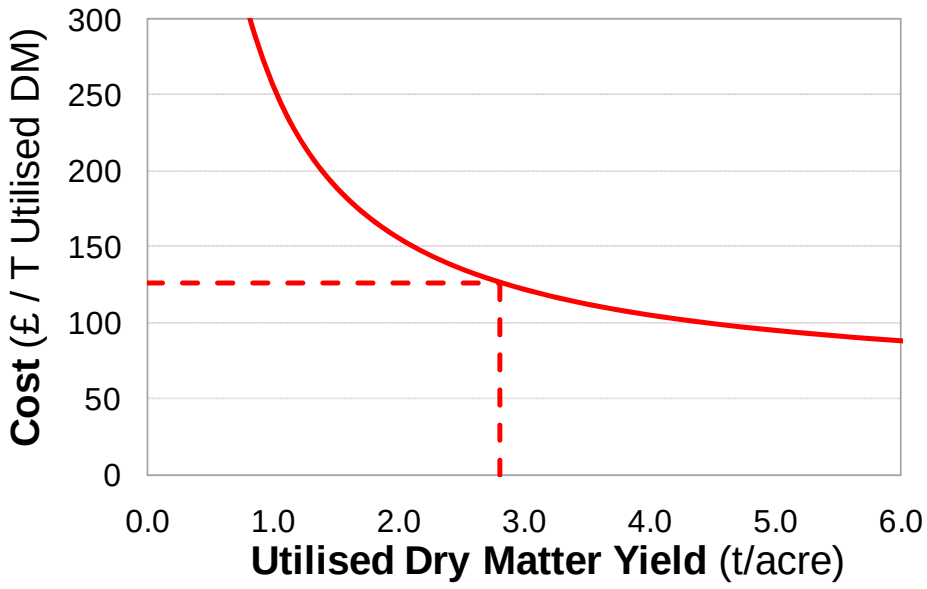
Fresh Yield	11 t/ha (4.6 t/ac)
Dry Matter	70%
Dry Matter Yield	8 t/ha (3.2 t/ac)
Percentage of dry matter that is utilised	87%
Utilised Dry Matter Yield	7 t/ha (2.8 t/ac)
Energy	14 MJ/KG DM
Crude Protein	10% in DM

Typical Cost & Value

	Total Costs	Cash Costs[1]
Cost per Hectare	£1,003	£830
Cost per tonne fresh weight	£88	£73
Cost per tonne utilised dry matter	£144	£119
Cost per MJ of metabolisable energy	1.0p	0.9p
Cost per 100g of Crude Protein	14.4p	11.9p

[1]Establishment, variable and machinery costs, excluding rent and clamp depreciation

PRODUCTION COSTS RELATIVE TO CROP YIELD



Solid red line:
Production cost depending on yield

Broken red line:
Yield and production costs for the example given in the tables

The very best agronomy is needed to ensure good yield and an acceptable cost for this protein rich feed

WHEAT GRAIN

Grain yields can be very high in favourable areas. Winter wheat will produce more yield than spring wheat, but inputs will be higher for winter wheat.
Sowing wheat after a break crop such as grass will produce the highest yield. Attention to agronomy will produce the best results. Feed varieties will produce the best yield of grain per hectare

Establishment	
Timing	Sow in late September to early November, increasing seed rate through the season, or in the spring.
Sowing	Cultivate to achieve a moderately coarse seedbed. Sow at 120kg/ha (50kg/ac) in September to 180kg/ha (75kg/ac) in November.
Variety selection	Select high yielding feed varieties to suit your conditions and disease risk.

Growing	
Soil pH	Keep soil pH above 6.0
Fertiliser	Fertiliser requirements will vary widely but a typical fertiliser N allowance is 200 kg N/ha (160 units N/ac) Refer to DEFRA's RB209 for more details and be aware of the optimum growth stages to apply the fertiliser.
Sprays	An effective spray regime needs to be matched to the conditions on your farm. Consult an agronomist and apply products at the right times or risk compromising yield.

Harvesting	
Harvest date	Harvest between 15% and 17% moisture content. Drier grain will reduce costs and storage grain pests.
Typical yield	Yields of 8t/ha (3.2t/ac) to 10t/ha (4.0t/ac) can be expected. Higher yields can be achieved in favourable areas.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Sow								Sow		
							Harvest				

Typical Yield and Quality

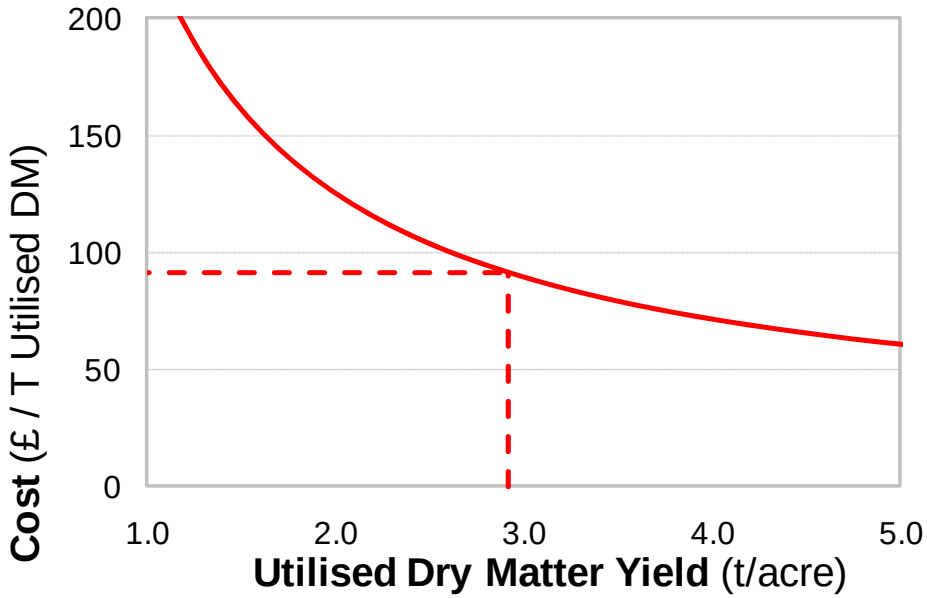
Fresh Yield	9 t/ha (3.8 t/ac)
Dry Matter	86%
Dry Matter Yield	8.0 t/ha (3.2 t/ac)
Percentage of dry matter that is utilised	90%
Utilised Dry Matter Yield	7.2 t/ha (2.9 t/ac)
Energy	13.7 MJ/KG DM
Crude Protein	12.8% in DM

Typical Cost & Value

	Total Costs	Cash Costs[1]
Cost per Hectare	£658	£438
Cost per tonne fresh weight	£71	£47
Cost per tonne utilised dry matter	£91	£61
Cost per MJ of metabolisable energy	0.7p	0.4p
Cost per 100g of Crude Protein	7.1p	4.7p

[1]Establishment, variable and machinery costs, excluding rent and clamp depreciation

PRODUCTION COSTS RELATIVE TO CROP YIELD



Solid red line:
Production cost depending on yield

Broken red line:
Yield and production costs for the example given in the tables

Quality agronomy is needed to achieve the best yields

BARLEY GRAIN

Barley can be grown in more marginal areas than wheat. Winter barley is higher yielding than spring barley, but inputs will be higher. It can be used effectively in sheep and cattle rations. Barley will provide a good source of starch and energy.

Establishment	
Timing	Winter barley will give the best yield of grain and straw. Sow between late September and mid October. Sow spring barley between February and April.
Sowing	Cultivate to achieve a moderately coarse seedbed. Sow at around 210kg/ha (85kg/ac) for winter barley and 175kg/ha (70 kg/ac) for spring barley.
Variety selection	Select high yielding feed varieties to suit your conditions.

Growing	
Soil pH	Keep soil pH above 6.0
Fertiliser	Fertiliser requirements will vary widely but a typical fertiliser N allowance is 180 kg N/ha (145 units N/ac) for winter barley Refer to DEFRA's RB209 for more details and be aware of the optimum growth stages to apply the fertiliser.
Sprays	An effective spray regime needs to be matched to the conditions on your farm. Consult an agronomist and apply products at the right times or risk compromising yield.

Harvesting	
Harvest date	Harvest at between 15% and 17% moisture. Harvesting drier grain will reduce costs and storage pests.
Typical yield	Winter barley will yield approximately 7.5 t/ha (3 t/ac). Spring barley will yield approximately 5.5 t/ha (2.2 t/ac).

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Sow								Sow		
						Harvest					

Typical Yield and Quality

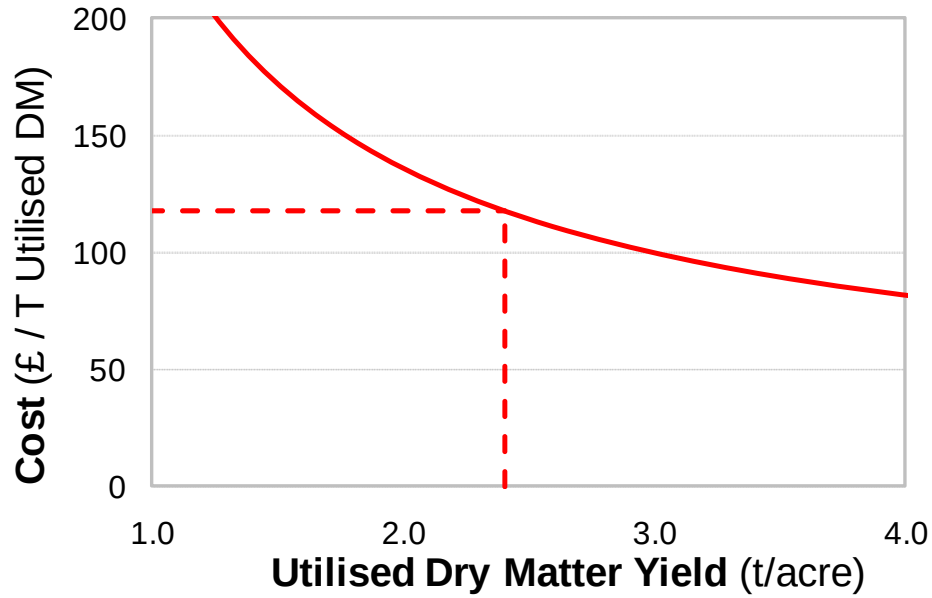
Fresh Yield	7.7 t/ha (3.1 t/ac)
Dry Matter	86%
Dry Matter Yield	6.6 t/ha (2.7 t/ac)
Percentage of dry matter that is utilised	90%
Utilised Dry Matter Yield	5.9 t/ha (2.4 t/ac)
Energy	13.3 MJ/KG DM
Crude Protein	12.9% in DM

Typical Cost & Value

	Total Costs	Cash Costs[1]
Cost per Hectare	£696	£458
Cost per tonne fresh weight	£91	£60
Cost per tonne utilised dry matter	£117	£77
Cost per MJ of metabolisable energy	0.9p	0.6p
Cost per 100g of Crude Protein	9.1p	6.0p

[1]Establishment, variable and machinery costs, excluding rent and clamp depreciation

PRODUCTION COSTS RELATIVE TO CROP YIELD



Solid red line:
Production cost depending on yield

Broken red line:
Yield and production costs for the example given in the tables

Well grown it is a good source of starch and energy

OAT GRAIN

Oats grow well in Northern England and Scotland. Inputs are lower than wheat and barley with grain yield being similar to barley. Oats are much higher in fibre than barley or wheat, but contain less starch. Straw yields can be substantial. Oats will grow on more acidic soils than wheat or barley.

Establishment	
Timing	Winter oat's will give the best grain yield and are likely to give the best whole crop yields so aim to sow late September - November.
Sowing	Cultivate to achieve a moderately coarse seedbed. Sow at around 190 kg seed/ha (77 kg/ac) for winter or spring oats.
Variety selection	Select high yielding varieties to suit your conditions.

Growing	
Soil pH	Keep soil pH between 5.5 and 6.5
Fertiliser	Fertiliser requirements will vary widely but a typical fertiliser N allowance is 120 kg N/ha (95 units N/ac) Refer to DEFRA's RB209 for more details and be aware of the optimum growth stages to apply the fertiliser.
Sprays	An effective spray regime needs to be matched to the conditions on your farm. Consult an agronomist and apply products at the right times or risk compromising yield. Spray input is usually low.

Harvesting	
Harvest date	Harvest between 15% and 17% moisture. Oats will require 40% more storage space than wheat or barley due to the low density of the grain.
Typical yields	7.5 t/ha (3 t/ac) for winter oats. 5 t/ha (2 t/ac) for spring oats.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Sow								Sow		
							Harvest				

Typical Yield and Quality

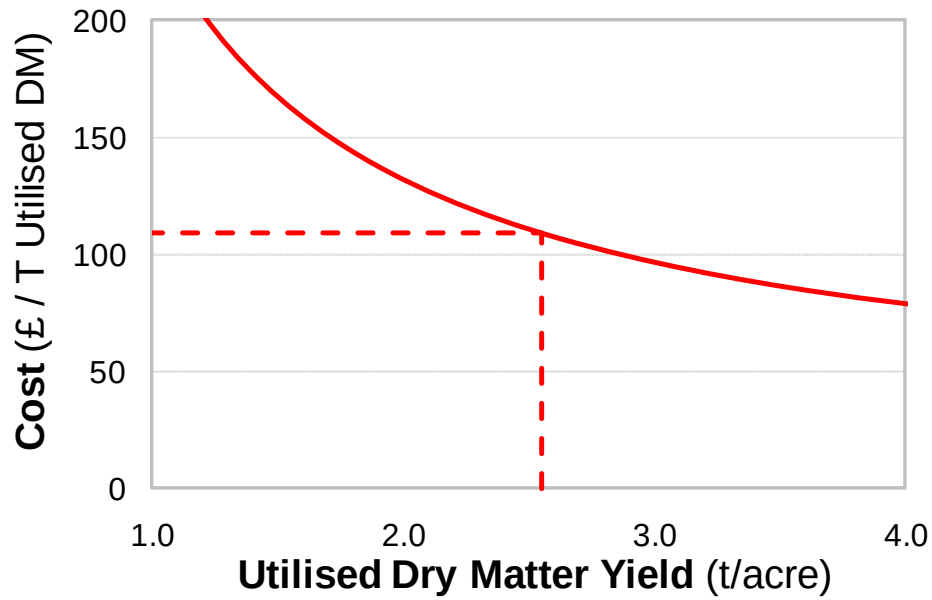
Fresh Yield	8 t/ha (3 t/ac)
Dry Matter	86%
Dry Matter Yield	7.0 t/ha (2.8 t/ac)
Percentage of dry matter that is utilised	90%
Utilised Dry Matter Yield	5.9 t/ha (2.4 t/ac)
Energy	12.1 MJ/KG DM
Crude Protein	10.5 % in DM

Typical Cost & Value

	Total Costs	Cash Costs[1]
Cost per Hectare	£688	£448
Cost per tonne fresh weight	£85	£55
Cost per tonne utilised dry matter	£109	£71
Cost per MJ of metabolisable energy	0.9p	0.6p
Cost per 100g of Crude Protein	10.4p	6.8p

[1]Establishment, variable and machinery costs, excluding rent and clamp depreciation

PRODUCTION COSTS RELATIVE TO CROP YIELD



Solid red line:
Production cost depending on yield

Broken red line:
Yield and production costs for the example given in the tables

A useful starch source for more marginal areas

TRITICALE GRAIN

Triticale is a hybrid of wheat and rye. This crop has a low nitrogen requirement compared to wheat and barley. It can be grown on marginal land where it is difficult to grow wheat or barley. Energy and protein levels are similar to wheat.

Establishment	
Timing	Triticale is primarily a winter crop usually drilled in September and October.
Sowing	Cultivate to achieve a moderately coarse seedbed. Sow at around 225 kg/ha (90 kg/ac).
Variety selection	Select high yielding varieties to suit your conditions

Growing	
Soil pH	Keep soil pH between 5.5 and 6.5
Fertiliser	Fertiliser requirements will vary widely but a typical fertiliser N allowance is 180 kg N/ha (145 units N/ac) Refer to DEFRA's RB209 for more details and be aware of the optimum growth stages to apply the fertiliser.
Sprays	An effective spray regime needs to be matched to the conditions on your farm. Consult an agronomist and apply products at the right times or risk compromising yield. Spray costs are generally low.

Harvesting	
Harvest date	Harvest period is similar to wheat. Harvest at between 15% and 17% moisture
Typical yield	Yields can be variable and range between 3 t/ha and 9 t/ha (1.2 t/ac and 3.6 t/ac).

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Sow								Sow		
							Harvesting				

Typical Yield and Quality

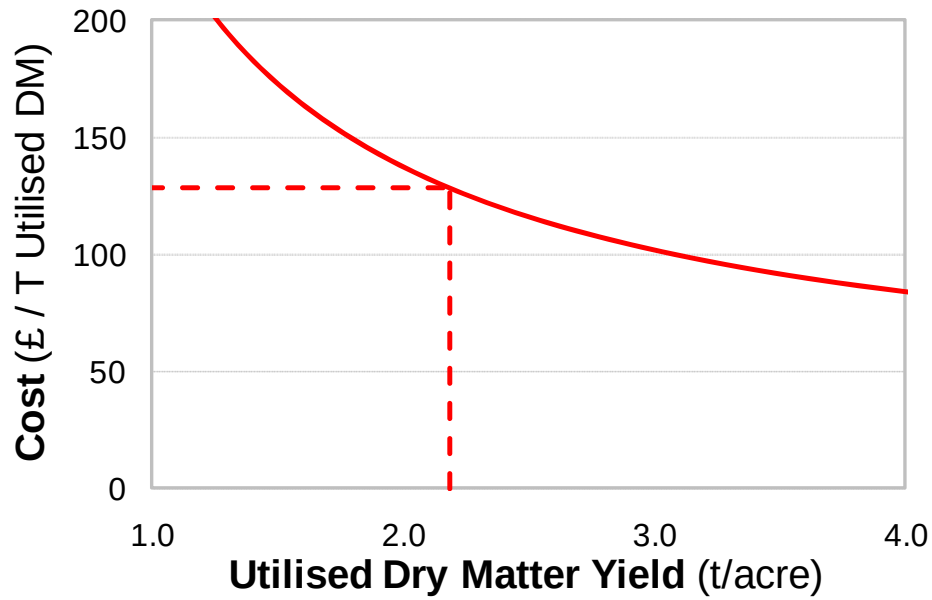
Fresh Yield	7 t/ha (2.8 t/ac)
Dry Matter	86%
Dry Matter Yield	6.0 t/ha (2.4 t/ac)
Percentage of dry matter that is utilised	90%
Utilised Dry Matter Yield	5.4 t/ha (2.2 t/ac)
Energy	13.8 MJ/KG DM
Crude Protein	13.1 % in DM

Typical Cost & Value

	Total Costs	Cash Costs[1]
Cost per Hectare	£694	£457
Cost per tonne fresh weight	£99	£65
Cost per tonne utilised dry matter	£128	£85
Cost per MJ of metabolisable energy	0.9p	0.6p
Cost per 100g of Crude Protein	9.8p	6.5p

[1]Establishment, variable and machinery costs, excluding rent and clamp depreciation

PRODUCTION COSTS RELATIVE TO CROP YIELD



Solid red line:
Production cost depending on yield

Broken red line:
Yield and production costs for the example given in the tables

A good option for less favourable ground. High straw yields.

WINTER FEED REOUIREMENTS

Evaluating your winter feed requirements and how much you have in stock will allow you to plan early and avoid potential costly feed shortages. This calculator sets out a quick and easy method to calculate not only the fresh weight (which can be misleading), but also how much dry matter is required and how much is available in the silo.

Key Points:

- Calculate how much forage is available and the quantity required
- Find ways to reduce pressure on forage stocks
- Check you are buying feeds efficiently

FORAGE

Before looking at how best to utilise your forage supplies it is important to calculate how much you will have available.

1. Use the tables below to calculate how much silage is available - include an estimate for crops not yet harvested
2. Calculate forage requirements
3. Calculate whether you have enough forage

1) Silage Availability - Write your figures over the grey example

	A	B	C	D	E	F	G	
Silage type	Clamp details (m)			Capacity (m^3) A x B x C	Density (from tables below)	Tonnes fresh D x E/1000	DM %	Tonnes of DM F x G/100
	Length	Width	Height					
1st cut Grass	*30*	*10*	*3.5*	*1050*	*615*	*646*	*30*	*194*
						Total clamp silage DM available (tonnes)		*194*

SILAGE DENSITY

GRASS SILAGE

DM %	Density (kg fresh wt/m^3)
20	725
25	660
30	615
35	600
40	590

MAIZE SILAGE

DM %	Density (kg fresh wt/m^3)
25	650
30	620
35	600

WHOLE CROP SILAGE

DM %	Density (kg fresh wt/m^3)
35	605
45	585
55	565

These figures are guidelines only. Density will depend on chop length, level of consolidation and depth of silage

Round Bales

	A	B	C	
Silage type	Number of bales	**Bale Weight** As a guide: 4' wide round bales weigh approx. 0.5 tonnes fresh 5' wide round bales weigh approx. 0.63 tonnes fresh	DM %	Tonnes of DM A x B X C / 100
2nd Grass	*400*	*0.63*	*30*	*76*
			Total round bale DM available (tonnes)	*76*

Crops in Field

	A	B	C	
Forage crop	Crop Area (Hectares)	**Expected Harvested Fresh Yield** (tonnes / hectare)	DM %	Tonnes of DM A x B X C / 100
1st cut Grass	*20*	*22*	*25*	*110*
			Total DM available (tonnes)	*110*

Total the amount of forage available

	Tonnes Dry Matter
Clamp Silage	*194*
Round Bale Silage	*76*
Crops in Field	*110*
Total Available	***380 tonnes DM***

2) Now calculate the stock requirements

Estimation of Silage Dry Matter Intake

The dry matter intake of stock can be estimated as a proportion of their liveweight. Deduct the amount of concentrates being fed (kg of dry matter) and any grazed forages, to give the estimated silage intake.

Stock Intakes

	B
Stock	Dry Matter Intake - % of liveweight
Rearing cattle	2.3%
Finishing cattle (	2.0%
Suckler cows	2.0%
Cull cows	2.0%
Ewes	1.7%
Lactating ewes	2.5%
Lambs	2%

Silage Requirements

	A	B	C	D	E	
	Number of stock	Average Liveweight (kg)	DMI as % of Liveweight (see above)	Daily requirement (kg) A x B x C	Feeding period (days)	Total dry matter required (tonnes) D x E/1000
Rearing cattle	*150*	*220*	*2.3*	*759*	*80*	*61*
Suckler Cows	*200*	*400*	*2.0*	*1600*	*140*	*224*
				Total Dry Matter to be eaten (tonnes)		285
				Safety margin – allow for losses etc. of 5-10%		21
				Total Tonnes of Dry Matter Required		*306*

3) Total Silage Shortfall or Surplus

Finally deduct the dry matter required form the dry matter available to give the overall shortfall or surplus

Total Dry Matter Available	*380*
Total Dry Matter Required	*306*
Surplus or Shortfall	*74t surplus*

MAKING UP A FORAGE SHORTFALL

Reducing forage usage:

- Reduce your stock numbers.
- Out winter stock

Alternative forage sources:

- Can you buy standing maize crops locally?
- Buy in moist feeds (brewers grains etc.)
- Sow turnips or kale into cereal stubbles for young stock and dry cow winter grazing
- Consider an alternative ration of straw and concentrates or liquid feeds, e.g. pot ale syrup
- Plant a grass catch crop after cereals and maize to allow an early spring turnout

Reduce waste:

- Keep the clamp face clean and ensure any mouldy silage from the top of the clamp is removed to prevent spoilage of the other feed in the trough
- If you are using a diet feeder check the weigh scales are calibrated and accurate
- Take regular silage analyses as you go back through the clamps and adjust for changes in quality
- Regularly clean out feed troughs

BUYING FEEDS

If you end up buying in extra feed be sure to spend your money well. Feed cost per tonne obviously has a big effect on your feed costs, but it is not necessarily the case that the less you spend, the lower your feed costs will be.

REDUCING THE COST OF BOUGHT IN FEEDS

- **Load size** – aim to take full loads, provided you can store the feed without it spoiling. Alternatively, share a load with a neighbour
- **Local Supplies –** with transport getting ever more expensive try to locate local sources of alternative feeds
- **Negotiation** –get quotes from a number of suppliers to check you are not paying too much, ask if there are discounts available for prompt payment, being able to take artics or bulk orders

Calculate your forage stocks prior to the winter so that you can make planned choices, rather than rushed decisions later in the winter

THE IMPORTANCE OF CROP ROTATIONS

A well designed rotation will focus on optimising production across the duration of the rotation and not just maximising yields on individual crops.
A good rotation will:

- Provide adequate crop nutrients and reduce bought in inputs
- Maintain soil fertility
- Reduce soil erosion by careful crop selection
- Improve soil structure through a combination of deep and shallow rooting crops
- Reduce the impact of specific pests and diseases
- Maintain or improve soil organic matter
- Provide sustainable cropping for livestock animals at specific times of year

A rotation can just be two crops or a number of different crops. The rotation will be dictated by soil type, topography, equipment available and type and production level of livestock.
Crops for livestock systems can be grouped as follows:

Cereals (wheat, barley, rye, triticale and oats)
These are harvested in field and stored as grain or forage. They inevitably remove nutrients from the soil. Cereals can be grown continuously in the same field, but will become increasingly prone to pests and diseases such as take-all in wheat.

Root crops (fodder beet, turnips and swedes)
Root crops can be grazed or harvested and stored. Fodder beet can be a high input crop, but potential yields are also high. Growing root crops continuously in the same field can cause cyst nematode to build up and a 3 to 4 year rotation is recommended.

Pulse crops/legumes (peas, beans, red clover, white clover, and lucerne)
Pulses and legumes will return nitrogen to the soil, which will then benefit the following crop. Growing peas and beans in close rotation will increase fungal diseases and pests such as pea cyst nematode.

Restorative crops (grazing leys, stubble turnips, kale, forage rape and other crops fed in field)
These crops are usually fed in field and therefore return a high proportion of nutrients. Brassicas if grown continuously in the same field can be susceptible to ‘club root’. Club root is caused by fungi which affects the rooting system. A 1 in 4 year rotation is recommended for controlling club root. Keeping soil pH above 6.5 can reduce the impact of club root.

Ensiled or zero grazed grass
Intensive cutting leys which may include clover remove large quantities of nutrients, particularly potash.

EXAMPLE ROTATIONS

Example rotations for beef farms

Intensive finishing plus grazing (suitable in an arable rotation) or
Autumn calving suckler cow (lowland situation in an arable rotation)

Year 1				Year 2				Year 3				Year 4				Year 5			
Spr.	Sum.	Aut.	Win.	Spr.	Sum.	Aut.	Win.	Spr.	Sum.	Aut.	Win.	Spr.	Sum.	Aut.	Win.	Spr.	Sum.	Aut.	Win.
Grass/Clover				Winter Wheat				Winter Beans				Forage Rye				Spring Barley (undersown)			
Grass/Clover																			

This rotation provides protein and starch for concentrate feeding as well as quality grazed forages with good nitrogen recycling.

Autumn calving suckler cow (upland/LFA/limited cropping)

Year 1				Year 2				Year 3				Year 4				Year 5			
Spr.	Sum.	Aut.	Win.	Spr.	Sum.	Aut.	Win.	Spr.	Sum.	Aut.	Win.	Spr.	Sum.	Aut.	Win.	Spr.	Sum.	Aut.	Win.
Grass/Clover				Kale or swedes				Grass/Clover											

The majority of feed is provided from well grown grass clover mixes, with a winter fodder crop providing extra winter keep or fodder for an early turnout. This crop also provides an opportunity to make excellent use of FYM and acts as a good entry for a new grazing ley.

Spring calving out wintered dry cows (lowland rotation)

Year 1				Year 2				Year 3				Year 4				Year 5			
Spr.	Sum.	Aut.	Win.	Spr.	Sum.	Aut.	Win.	Spr.	Sum.	Aut.	Win.	Spr.	Sum.	Aut.	Win.	Spr.	Sum.	Aut.	Win.
Grass				Kale or stubble turnips				Spring whole crop				Grass/Clover							

Ideal on lighter farms, but be sure to provide a dry lying area and a fibre source for the stock on winter fodder crops. Spring whole crop will provide a winter feed for youngstock.

Spring calving partially out wintered dry cows (upland/LFA/limited cropping)

Year 1				Year 2				Year 3				Year 4				Year 5			
Spr.	Sum.	Aut.	Win.	Spr.	Sum.	Aut.	Win.	Spr.	Sum.	Aut.	Win.	Spr.	Sum.	Aut.	Win.	Spr.	Sum.	Aut.	Win.
Grass/ Clover		**Kale or turnips**		**Grass/Clover**															

Kale or turnips will provide winter grazing for dry cows and early grazing after calving. Cows can be buffered with round bale grass silage which is pre-placed in the field.

Store cattle/rearing cattle out wintered (lowland with arable in the rotation)

Year 1				Year 2				Year 3				Year 4				Year 5			
Spr.	Sum.	Aut.	Win.	Spr.	Sum.	Aut.	Win.	Spr.	Sum.	Aut.	Win.	Spr.	Sum.	Aut.	Win.	Spr.	Sum.	Aut.	Win.
Grass/Clover				**Fodder Beet**				**Spring Barley (undersown)**				**Grass/Clover**							

Cattle can be out-wintered on grass/grass silage and fodder beet. This can be grazed in situ or lifted and fed. A protein source may be required to maintain growth rates.

Example rotations for sheep farms

Lowland March lambing ewes (in an arable rotation)

Year 1				Year 2				Year 3				Year 4				Year 5			
Spr.	Sum.	Aut.	Win.	Spr.	Sum.	Aut.	Win.	Spr.	Sum.	Aut.	Win.	Spr.	Sum.	Aut.	Win.	Spr.	Sum.	Aut.	Win.
Grass/Clover				Winter wheat/barley				Winter beans				Forage rye				Spring Barley (undersown)			
Grass/Clover																			

This rotation provides protein and starch for concentrate feeding and hay or silage for winter feed. Nitrogen recycling is good. Swards can be closed up in late summer/Autumn to act as standing hay/deferred grazing for winter keep

Lowland lamb finishing (in an arable rotation)

Year 1				Year 2				Year 3				Year 4				Year 5			
Spr.	Sum.	Aut.	Win.	Spr.	Sum.	Aut.	Win.	Spr.	Sum.	Aut.	Win.	Spr.	Sum.	Aut.	Win.	Spr.	Sum.	Aut.	Win.
Grass/Clover				Winter Barley				Kale or turnips				Spring Barley (undersown)				Grass/Clover			

Lambs mostly finished off grass. Barley will provide an energy source for creep feeding, but a protein source will need to be bought in.

Lowland lamb finishing (weaned in early summer)

Year 1				Year 2				Year 3				Year 4				Year 5			
Spr.	Sum.	Aut.	Win.	Spr.	Sum.	Aut.	Win.	Spr.	Sum.	Aut.	Win.	Spr.	Sum.	Aut.	Win.	Spr.	Sum.	Aut.	Win.
Grass/Clover				Summer turnips				Winter Barley				Grass/Clover							

Lambs mostly finished on turnips. Barley will provide an energy source. A protein source will be needed for finishing.

Less favoured area lamb finishing (limited cropping potential)

Year 1				Year 2				Year 3				Year 4				Year 5			
Spr.	Sum.	Aut.	Win.	Spr.	Sum.	Aut.	Win.	Spr.	Sum.	Aut.	Win.	Spr.	Sum.	Aut.	Win.	Spr.	Sum.	Aut.	Win.
Grass/Clover				Chicory/Plantain/PRG								Grass/Clover							

Chicory/Plantain will provide winter grazing. Extra energy and protein may be required for finishing.

Less favoured area ewes lambing in April (limited cropping potential)

Year 1				Year 2				Year 3				Year 4				Year 5			
Spr.	Sum.	Aut.	Win.	Spr.	Sum.	Aut.	Win.	Spr.	Sum.	Aut.	Win.	Spr.	Sum.	Aut.	Win.	Spr.	Sum.	Aut.	Win.
Grass/Clover				Kale				Grass/Clover											

Ewes out-wintered on kale. Good entry for new grass leys in late summer. Store lambs sold off grass. Hay for buffer feeding. Swards can be closed up in late summer/autumn for deferred grazing.

STOCKING RATE GUIDE

It is important to know how much your stock need to eat and to ensure you are supplying adequate feed.
Monitoring grass growth with a plate meter, or cutting a small area of the sward or fodder crop will help you determine the dry matter yield of your crop.

Plate meter:

1. Walk a 'W' pattern in each field
2. Record the kilo's of dry matter yield per hectare
3. Subtract the typical residual grass level, e.g. 2,500kg DM/ha – 1,500kg DM/ha = 1,000kg DM/ha
4. Use this in the table below to determine the number of days grazing in each field.

Quadrant:

1. Make a 1m square frame
2. Place this over the crop
3. Use garden shears to cut the crop in this $1m^2$ area at grazing height
4. Collect this into a feed bag
5. Weight the crop using hand scales
6. Multiply this weight by 10,000 to get fresh matter yield per hectare
7. Multiply this by the expected crop dry matter (see appropriate page in the report)
8. This gives dry matter yield per hectare

A	B	C	D	E	F	G	H
Field Name	Crop type	Field size (ha)	Dry matter in field (kg DM/ha)	Number of livestock	Livestock requirement (kg DM/head/day)	Total crop requirement per day (kg DM) =E x F	Number of days grazing in the field = C x D / G
e.g., Hill field	Grass	10	1,000	100	10	1,000	10

OVERVIEW OF FORAGE QUALITY & COSTS

Crop	Fresh Matter Yield (t/ha)	Utilised Dry Matter Yield (t/ha)	Energy (MJ/kg DM)	Crude Protein (% in DM)	Cost per tonne of fresh matter (£/t FM)	Cost per tonne of utilised dry matter (£/t FM)
Grazed Grass	64.7	8.8	11.5	17.0%	£10	**£75**
Grazed Grass (20%WC)	64.7	8.8	11.5	19.0%	£10	**£72**
Grazed Grass (High Clover, Low N)	57.1	7.8	11.5	19.0%	£10	**£75**
Grazed Grass (old pasture)	50.0	6.0	10.5	15.0%	£10	**£82**
Chicory, PRG & WC	66.7	8.0	11.0	20.0%	£9	**£77**
Summer Turnips	66.7	5.1	11.2	17.0%	£6	**£81**
Grazed Kale	58.7	7.5	11.0	16.8%	£9	**£67**
Forage Rape	34.6	3.8	10.5	19.0%	£12	**£107**
Stubble Turnips	61.1	4.7	11.2	17.0%	£5	**£66**
Swedes	77.0	6.5	12.9	10.0%	£5	**£62**
Forage Rye	27.5	4.4	10.0	11.0%	£12	**£78**
Grass Silage (1st Cut)	22.8	5.0	11.2	15.0%	£23	**£105**
Grass Silage (Late 1st cut)	25.2	5.9	10.3	13.0%	£23	**£98**
Grass Silage (2nd Cut)	12.7	3.3	11.0	14.0%	£30	**£116**
Grass Silage (3rd Cut)	7.3	1.9	10.8	14.0%	£34	**£128**
Round Bale Silage (1st Cut)	16.3	5.0	11.2	15.0%	£34	**£111**
Round Bale Silage (Late 1st Cut)	19.4	5.9	10.8	13.0%	£31	**£102**
Round Bale Silage (2nd Cut)	10.9	3.3	10.8	14.0%	£38	**£126**
Round Bale Silage (3rd Cut)	6.3	1.9	10.8	14.0%	£43	**£142**
Italian Rye Grass (3 Cuts)	51.9	12.2	11.0	13.0%	£26	**£110**
Italian Rye Grass + RC (3 Cuts)	48.9	11.5	10.8	17.0%	£25	**£105**
Lucerne	40.0	10.4	10.0	18.0%	£37	**£140**
Forage Peas	26.7	7.0	9.9	17.0%	£27	**£102**
Fodder Beet	93.8	12.8	13.0	12.5%	£16	**£115**
Maize	41.9	11.7	11.2	9.0%	£28	**£100**
Maize under Plastic	43.8	12.2	11.2	9.0%	£29	**£103**
Wholecrop Silage	30.0	10.4	10.4	10.0%	£34	**£98**
Alkalage	17.1	11.1	11.0	17.0%	£73	**£111**
Crimped Wheat	13.3	7.0	13.0	10.0%	£85	**£163**
Grain Maize	12.9	7.8	14.0	10.0%	£99	**£162**
Dry Peas	5.1	4.0	13.5	25.0%	£126	**£162**
Dry Field Beans	8.1	6.3	14.8	36.0%	£78	**£101**
Dry Lupins	11.4	7.0	14.0	10.0%	£88	**£144**
Wheat Grain	9.3	7.2	13.7	12.8%	£71	**£91**
Barley Grain	7.7	5.9	13.3	12.9%	£91	**£117**
Oat Grain	8.1	6.3	12.1	10.5%	£85	**£109**
Triticale Grain	7.0	5.4	13.8	13.1%	£99	**£128**