

Section 6

Feeding the Dairy Cow

by Siobhan Kavanagh



Introduction

A dairy cow must eat a balanced diet with enough energy, protein, fibre, water, minerals and vitamins to cover her own maintenance and growth as well as milk production and the needs of a growing foetus. Quantity and quality are important.

- ① What are the feed requirements of the milking cow?
- ② What are the feed requirements of the dry cow?
- ③ How do I optimise my feed costs?
- ④ What forage options are available to me?

Feeding the Dairy Cow

1 What are the feed requirements of the milking cow?

SPRING

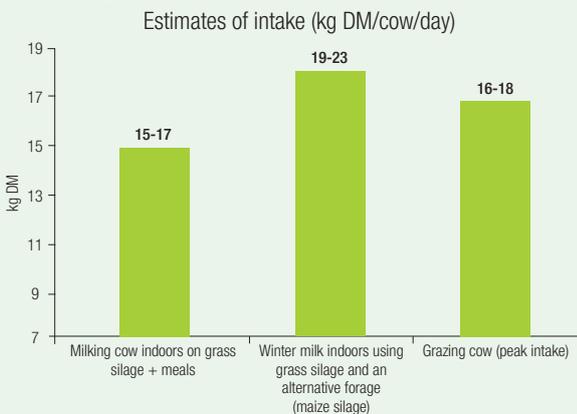
A cow will reach her highest daily milk output 6-8 weeks after calving but will only reach her highest intake of dry matter 10-12 weeks after calving. The cow will use energy from her fat reserves ('off her back') to make up the energy deficit for several weeks. However, if the cow loses too much body condition in early lactation, it can reduce her chances of getting back in calf again.

Cows calving onto a grass-based diet will eat a total dry matter intake (DMI) of 8-10kg DM (grass + concentrates) in week one after calving. Intake will increase by 0.75-1.0kg DM every week until they reach peak intake at 16-18kg DM during week 10-12 of the lactation.

In spring, the aim is that the cow should graze a high amount of quality grass with appropriate supplementation. When less than 8kg of grass dry matter per cow is available, the deficit should be made up with a forage e.g. grass silage, as well as concentrate. This will ensure the cow is getting enough fibre. Stop feeding silage when enough fresh grass is available.

Key fact

Intake drives performance in the spring calving herd.



Winter milk herds

Decrease supplementation rates by 1-2kg if using a blend of forages - grass silage plus maize silage or whole crop cereal silage. 10kg of fodder beet is equivalent to 2kg ration, but balance for protein.

Key performance indicator



The milking cow should receive adequate feed to optimise milk solids production and keep body weight loss to less than 0.5 BCS between calving and breeding.

Checklist



Which factors can cause low dry matter intake?



Checklist



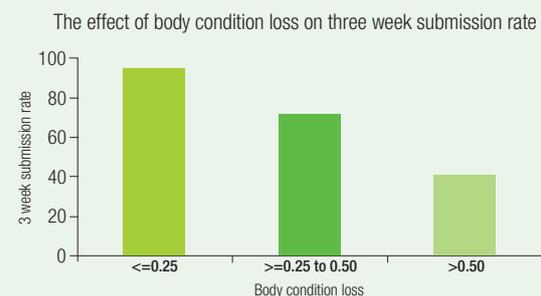
How do I know if an animal's dry matter intake is low?

1. Excessive body weight loss
2. Low milk yields
3. Low milk solids
4. Poor fertility
5. Metabolic diseases

Key risk



If body condition loss in early lactation is 0.5 BCS or greater, cow fertility will suffer.



Key risk



There is no grass available for grazing. This applies to winter feeding for autumn calving herds and in severe situations where no grazed grass is available in spring. The following supplementation rates apply:

Kg concentrate/cow/day

Silage DMD (%)	75%	70%	65%
Dry + well preserved			
Supplement (27 litres)	6.5	7.5	8.5
Supplement (32 litres)	8.5	9.5	10.5

Increase by 1-2kg if silage is wet and/or poorly preserved

Targets for total diet composition for winter milk dairy cows

	Lactating Cow		
	Early-peak ¹	Mid-late	Dry cow
Dry matter intake (kg/day)	21.0	16.0	11.0
Energy UFL (per kg DM)	0.95-1.0	0.85-0.9	0.75
Fibre (min): NDF (%)	32	-	-
ADF (%)	21	-	-
Starch (max)	22	-	-
Oil (max)	5-6	-	-
Protein PDI (g/kg DM)	105-110	95	70
Crude protein (%)	17	15-16	13
Mineral profile (% of diet)			
Ca	0.8	0.7	0.4
P	0.4	0.35	0.3
Na	1.7	1.5	1.0
Mg	0.3	0.25	0.28

¹ peaking at 38-40kg milk

How to

Manage supplementation at grass in spring



- Supplementation rates will be dictated by cow production level and grass availability.
- Grass budgeting is an important decision support tool in deciding on a supplementation strategy.

- Supplementation required
= Cow requirements for energy - grass energy intake.

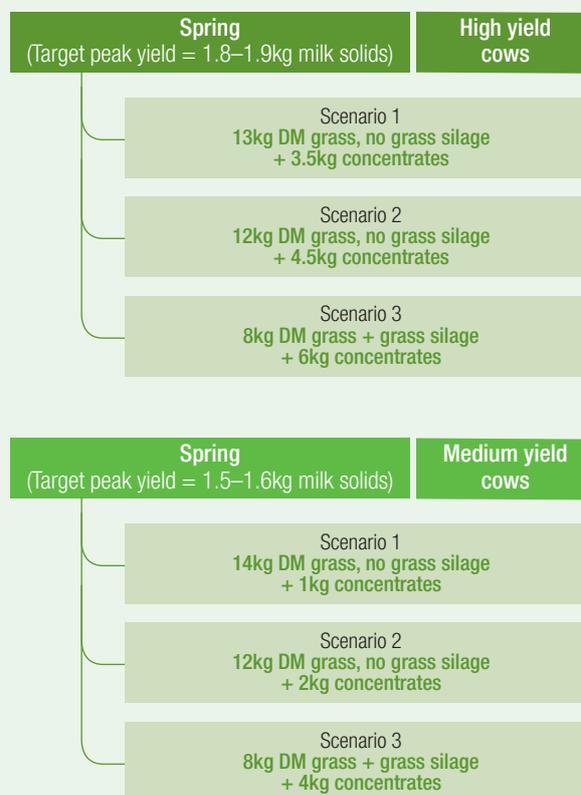
Rule of thumb

Six to eight weeks after calving 13kg DM of grass plus 3.5 kg as fed concentrates will deliver a peak yield of 1.8-1.9kg milk solids (28 litres/6 gallons). If less grass is available, more supplements will be needed. If output is lower, then supplementation rates can be reduced (see diagram). As intake capacity increases, the cow will gradually reach peak intake of 16-18kg of grass dry matter.

Rule of thumb

- An increase of 1% in grass digestibility will increase dry matter intake by 0.3-0.4kg DM and milk yield by 0.25 litres.

Supplementation rates for a spring calving herd



Increase supplementation rates by 1-2kg as milk solids production increases by 0.3-0.4kg/day.

Feeding the Dairy Cow

Key fact



Energy, not protein or minerals, is the most limiting nutrient in dairy production systems. If animals are not milking as well as expected, or milk protein is low or cows are losing excessive condition, energy is the first nutrient to check. Check the total dry matter intake of the animal as well as the quality (i.e. energy content) of the forages/feeds used.

Digestive upsets

Build up concentrate levels gradually to reduce the risk. Pay particular attention to first calvers when feeding high concentrate levels.

Insufficient energy in the cow's diet

Insufficient energy in the milking cow's diet can result in low milk protein, low milk yields, poor fertility, poor immunity – susceptibility to disease and metabolic disorders including ketosis etc. – as well as loss of body condition.

Not enough protein

1. In early spring – the level of protein in spring grass is high, but the quality may not be adequate for the freshly calved cow.
2. In mid-summer – during a drought situation when grass becomes stemmy, protein levels in the grass can drop and may limit production.
3. Examples of low protein feeds are forage maize, whole crop cereal silage, fodder beet and low protein concentrates such as citrus pulp. Balance these with high protein feeds to ensure adequate protein in the animal's diet.

Too much protein?

Excessive protein can result in excessive body weight loss as the cow metabolises the extra protein. Avoid feeding high protein diets during the breeding season.

Magnesium deficiency

Dairy cows are at high risk of grass tetany (staggers) particularly on lush grass rich in potassium and nitrogen in cold, wet, conditions. It can also occur on autumn grass. Cows need to be supplemented with 30g of magnesium (or 60g of calcined magnesite) per day - during the high risk period.

Cows can't get quick access to water

Dairy cows can drink more than half of their water needs within a few hours of milking. Cows can drink quickly - up to 14 litres(3 gallons)/minute. It is important that the infrastructure and water flow rates adequate to meet the demands of the herd. See also Grazing Infrastructure.

Minerals and vitamins

Get the mineral status of your grazed grass checked regularly so that you get the correct mineral formulation to meet the needs of the herd.



Checklist

Minerals for the milking cow

1. Ensure that the inclusion rate of magnesium matches the requirements of the cow during the tetany period for different feeding rates.

Feeding rate kg per cow/day	% calmag needed in ration to supply 60g calmag or 30g of magnesium
	60g calmag (%)
1	6.0
2	3.0
3	2.0
4	1.5
5	1.2
6	1.0

1	6.0
2	3.0
3	2.0
4	1.5
5	1.2
6	1.0

2. Check that the inclusion rate of trace elements is adequate to meet the requirements of the cow.

The table below presents typical supplementation rates of trace elements for milking cows. The lower end of the range is for routine use and the higher levels are for stock at risk of severe deficiency.

Checklist "What the animal needs to get per day" (in mg)

Trace Elements

Copper	150-300
Selenium	3-5
Iodine	12-50
Cobalt	5-10
Manganese	335-415
Zinc	335-750

3. If concentrate feeds are being removed from the diet in early lactation, an alternative method of mineral supplementation should be used.

Methods of magnesium supplementation include:

- pasture dusting
- low feeding rate carrier concentrate feed
- water application

Buckets and licks are not recommended for milking cows as intake is too variable.

Methods of mineral supplementation

	Cost cents /cow /day	Comments
Ration (1.5–2 kg carrier) ¹	35-46	Convenient but can be costly; using straights e.g. citrus pulp to carry the mineral can be dangerous as Mg may separate out
Pasture dusting magnesium	13-20	Labour input required
Drinking water (commercial products)		
Mg only	15	Need a dispensing system will supply magnesium and/or trace elements, re-adjust the dispenser during wet weather.
Mg + TE	22	
TE only (I, Cu, Se, Zn)	13	
Drinking water (added directly) Magnesium sulphate flakes	c. 7-10	For large herds may need to split the dose morning & evening
Tablets in the water	4-7	Will supply individual trace elements e.g. copper, iodine and selenium.
Boluses	€5-6/ bolus, x 2	Will supply a blend of trace elements over 3-6 months. Always check the label for minerals supplied. Magnesium bullets will not supply adequate magnesium during tetany period

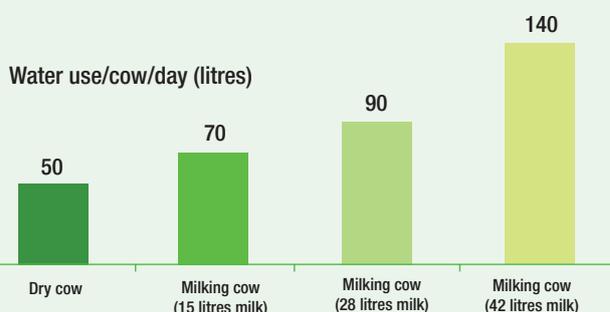
¹ concentrate of €230/t

Checklist



Ensure cows have adequate water

How much a cow will drink depends on milk yield, feed dry matter and weather. Water should always be clean.



Feeding the Dairy Cow

BREEDING/MAIN GRAZING SEASON

During the breeding season, it is essential to ensure that the nutrient intake of the cow is adequate to meet the needs of the cow and doesn't fluctuate. Grazed grass will provide adequate protein for the breeding cow.

The aim is to achieve high cow performance from an all-grass diet. There should be no need for supplements if grass supply and grazing conditions are suitable. Many herds reach peak yield in early May.

Rule of thumb

- Milk yield will drop on average by 2.5%/week (10%/month) from peak yield.

Checklist

For adequate feeding during the breeding/main season

1. Aim for a herd average body condition score of 2.9 at the beginning of the breeding season.
2. Ensure cows are gradually gaining weight.
3. Avoid fluctuations in dry matter/energy intake. Under good grazing conditions, the energy and protein needs of the cow during the breeding season can be met from grass only at a production level of 1.8–1.9kg milk solids per day. Supplement with 2–3kg concentrates during poor grazing conditions but stop when conditions improve. Concentrates should not be used as substitute for good grassland management.
4. Avoid high protein supplements (more than 18%) during the breeding season.
5. Mineral supplementation during the breeding season will depend on individual herd circumstances. Iodine should be fed to cows throughout the breeding season and mineral analysis of forage and blood will help to identify any other deficiencies.
6. All the common metabolic conditions (including milk fever, ketosis, displaced abomasum, fatty liver etc.) will have a negative impact on fertility.



Key fact

Concentrate supplementation is not economic for animals with low genetic merit for milk production in the main grazing season.

AUTUMN

Key objectives in the autumn are: to maximize the amount of grazed grass in the cow's diet and to ensure that the farm is closed up correctly to allow for adequate grass the following spring. Every 1kg DM grass/ha left on the paddocks in early November will result in 1.6kg DM grass/ha available for grazing in spring.

Key fact

Keeping cows at grass in the autumn time is worth over €1 per cow per day.

The feed value of grass drops significantly in the autumn. However, the milk solids output of the cow is also lower and her needs are significantly reduced.

Autumn - Why supplement?

1. Supplementation will reduce demand for grass and help build grass for autumn grazing season.
2. It maintains milk lactose levels and reduces the risk of penalties.
3. It maintains milk production, provided the quota is not limiting.
4. It increases cow body condition before drying off.

Late lactation feeding

The response to feeding concentrates with autumn grass is 1 litre of milk for every 1kg concentrates fed. In most situations this is economical except where milk price is low and concentrate price is high or in a year where there is an oversupply of milk (i.e. over quota).

If grazing full-time, 2-3kg of a high-energy low-protein concentrate is adequate.

If cows are indoors on grass silage (68-70 DMD), 3-4kg of concentrates (UFL = 0.94+, CP = 18%) will support 10-12 litres of milk (0.7-0.9kg milk solids).

2 What are the feed requirements of the dry cow?

Cows should have an eight-week dry period in preparation for the next lactation. This may need to be extended if cows are in very poor condition. During the dry period the cow's diet must be managed to ensure she calves down and begins the next lactation in the correct 'body-condition'. If the cow is too fat or too thin at calving, subsequent milk production and fertility will suffer. Nutrition-related problems around calving such as milk fever and retained cleanings can also have significant effects on subsequent production in the herd.

Key Fact

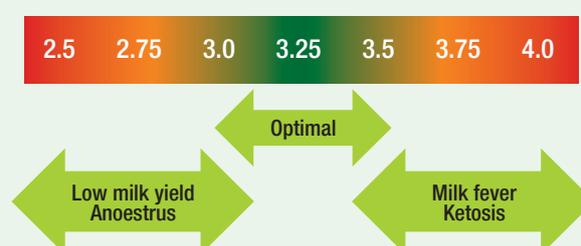
Thin cows need a longer dry period to prepare for the next lactation

Expected calving date	Length of dry period		
	8 weeks	10 weeks	12 weeks
	Dry off date	Dry off date	Dry off date
Feb 1	Nov 30	Nov 16	Nov 2
Feb 8	Dec 7	Nov 23	Nov 9
Feb 15	Dec 14	Nov 30	Nov 16
Feb 22	Dec 21	Dec 7	Nov 23
Mar 1	Dec 28	Dec 14	Nov 30

How to

Ensure cows have correct body condition score at calving

Body condition score at calving



- Check the body condition score of the herd at least 14 weeks before the beginning of the calving season (typically mid-October for a spring calving herd).
- Cows should be dried off at body condition score 3.25 – which is the condition that they should calve down in.
- Where there is variation, batch cows according to body condition score and calving date and feed accordingly.
- Aim to feed grass silage of 68% DMD for the dry cow.
- If cows are underconditioned, allow a longer dry period and feed 1-3kg of a low protein supplement e.g. rolled barley.
- Cows who need to put on 0.5 BCS will do so over an 8-10-week dry period on 68% DMD silage + 1-2kg concentrate feeds. If silage quality is poor (60-65% DMD), the dry period should be extended and/or supplementation rates increased. To gain 1.0 unit of BCS, cows will require 12-14 weeks dry on 68% DMD silage + 2-3kg concentrate feed.

Silage DMD	BCS 2.5 (12-14 weeks dry)	BCS 2.75 (8-10 weeks dry)	BCS >3.0 (8 weeks dry)
>72	Silage +1kg meals	Silage ad-lib	Silage Restricted
68-72	Silage +2kg meals	Silage +1kg meals	Silage ad-lib
64-68	Silage +3kg meals	Silage +2kg meals	Silage +1kg meals

For example, if cows have a body condition score of 2.5 at drying off, they should be dry for 12–14 weeks. If silage quality is 68-72 DMD, they should be offered silage ad lib and 2kg of a low-protein concentrate e.g. rolled barley.

Feeding the Dairy Cow

- Avoid overconditioning cows. This can be a problem with late calving cows with a long dry period or where excellent quality silage is available. If necessary, dilute the silage with a low energy feed such as straw.
- There is no advantage in feeding additional protein (with grass silage) to cows during the dry period, except where low protein feeds such as straw, maize silage, whole crop cereal silage and fodder beet are used in significant quantities.

Rule of thumb

Every condition score (~ 50 kg) below target at calving results in the cow milking 450 litres less during the next lactation and having reduced fertility.

Key risk

I am short of silage



Feeding the minimum amount of roughage and concentrates can be more economical than buying expensive silage. Feeding the cow 20kg grass silage plus 5kg straw plus 3-4kg concentrates will maintain dry cows and put on 0.2-0.3 BCS.

1. Concentrates to balance hay and straw should contain high levels of crude protein (18-20%).
2. Ensure adequate feeding space so that all animals can feed at the same time.
3. Introduce concentrates slowly.
4. Feed twice daily if above 3kg per day.
5. A supply of clean water is essential.

Feeding pre-calver minerals

Feed minerals to all dry cows for 4-6 weeks pre-calving. Fixed rate feeding is best. Free choice supplementation e.g. mineral buckets is not reliable as intake is variable. Ensure there is adequate feeding space for all animals to eat at the same time. Spread minerals across the silage and do it twice a day.

Checklist



What a dry cow mineral should supply

The table below presents a typical pre-calver mineral diet for dry cows. For example: The dry cow mineral should supply 20-25g of magnesium to meet the cow's magnesium requirement during the dry period. The mineral should also supply 4-5mg selenium.

	% inclusion in the mineral diet (%)	Supply in 100g feeding rate
Major elements		
Calcium	0	0
Phosphorous	0-4	0-4
Sodium	15	15
Magnesium	20-25	20-25
	"What you see on the label" (mg)	"What the animal gets per day" (Mg)
Trace elements		
Copper	2,700	324
Selenium	50	5
Iodine	500	50
Cobalt	100	10
Manganese	1,000	100
Zinc	5,000	500

Key Risk

Inadequate mineral intake pre-calving



Inadequate mineral supplementation during the dry period can cause problems with perinatal calf health as well as problems with cow health. These include clinical and sub-clinical milk fever, retained cleanings, low dry matter intake, ketosis, displaced abomasums and subsequent fertility problems

Always check that the:

1. specification of the pre-calver mineral meets the major and trace element requirements of the herd.
2. feeding rate is correct.
3. minerals are fed twice daily.

How to

Feed brassica crops (kale, rape etc.) in the field



1. Estimate the amount of fresh matter offered to the herd each day (i.e. the size of the break). Unless you have an accurate way of estimating yield, it is trial and error in allocation. Start with a small allocation and build up gradually.
2. While research has shown that kale can be fed at 100% of the diet, this requires a very high level of management. Feed at least 20% of the dry matter intake as grass silage or straw.
3. Brassicas must be strip-grazed.
4. Crop breaks should be long and narrow rather than short and wide, so that all cows can have access to the fresh break and trampling is kept to a minimum.
5. Adapt animals gradually to brassica crops over at least one week.
6. Ensure that fencing is very secure as poisoning can occur if animals overgraze/gorge on the crop.
7. Feed a quality mineral high in iodine and copper.
8. Crops should be grazed out before flowering; flowering brassica crops are poisonous. Aim for the final grazing to be completed before mid-March.
9. Feeding brassica crops in frosty conditions is not recommended, so feed only when the frost has thawed.
10. For milking cows, brassicas should not exceed 40% of the total dry matter intake as there is a risk of milk taint.

③ How do I optimise my feed costs?

The feeding system

1. Keep feeding systems simple.
2. Limit the feed categories on the farm to 3-4 e.g. grazed grass, grass silage and concentrates.
3. Feeding systems that require the use of straight ingredients, alternative forages and wet feedstuffs will increase the variable and fixed costs on the farm. They also change the focus from maximizing cheap grass utilisation on the farm.

Grass

1. Learn to budget grass – this will provide the confidence to know when there is enough grass available to meet the requirement of the cow without supplementation.
2. Maximise grass utilisation – aim for 70%+ of the feed budget of the cow to come from grazed grass.
3. Calve cows to grass to minimize the utilization of expensive conserved forages and concentrates.
4. Build up grass for autumn grazing and minimise the length of the winter period.

Supplementation strategy

1. Use concentrate feeds strategically:
 - a. to fill gaps in grass supply, particularly during spring and autumn
 - b. during the breeding season when grazing conditions are poor or grass supply is limited. Be prepared to remove the supplement when grass supply and intake are adequate
 - c. by using concentrates and/or high quality surplus bales (conserved during the main grazing season) to fill the gap in autumn when grass supply falls.

Feeding the Dairy Cow

2. Trace elements are important for fertility but there is no need to feed an extra 400-500kg concentrates per year to deliver them. Separate out the requirement for minerals and supplements from the need for energy and protein.
3. Low milk fat/protein. In most cases the economic response to feed products etc., is very poor. In most cases a significant drop in milk protein is due to grass quality. Improve grazing management skills. It's cheaper than buying in supplements. Cows can have low rumen pH at grass and still be healthy. Don't overreact to short-term drops in milk fat.
4. At high stocking rates (3.0 LU/ha) additional feed will need to be imported to bridge gaps in grass supply, particularly at the 'shoulders' of the year.
 - a. A concentrate mix fed through the parlour is the least labour intensive.
 - b. The use of alternative forages such as maize silage can be very labour intensive and incur high fixed costs.
 - c. Weigh up the relative value of the feed as well as the labour and fixed costs attached to feed-out.

Buying supplements

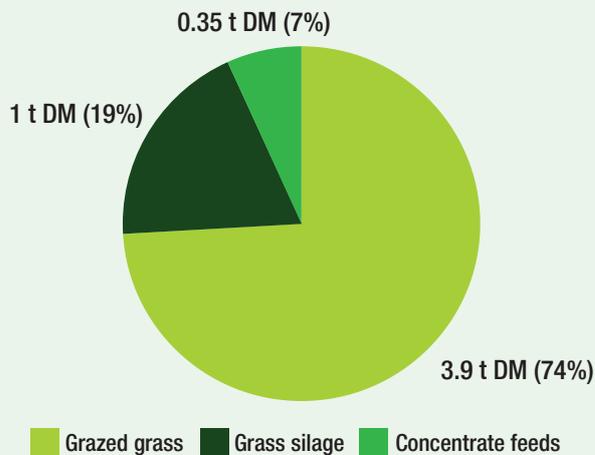
1. Know the nutrient requirements of the cow.
2. Energy is the most limiting nutrient in dairy production systems. Buy your concentrate feeds based on energy content.
3. Protein is important but concentrate feeds should be purchased on the basis of energy content firstly and then protein. High protein does not automatically mean good quality.
4. Low cost is the aim but this does not mean that the cheapest option is best. Low energy or imbalanced feed ingredients can be poor value on an energy basis.
5. Fancy supplements used in concentrate feeds are generally unnecessary and are no substitute for good feeding management.
6. Shop around for concentrate feeds – there is often large variation in price between suppliers.

4 What forage options are available to me?

Grazed grass is our cheapest feed and should make up as much of the cow's diet as possible. Forages such as whole crop forage maize, whole crop cereal silage, fodder beet or other wet feeds can have only a limited role in spring calving herds, except at high stocking rates. At high stocking rates their use will be decided by their value relative to concentrate feeds. Fixed costs, as well as variable costs tend to increase where alternative feeds are used. Brassica crops may have a role to play in drier parts of the country to reduce winter feed and housing costs.

Annual feed budget for a spring calving cow

Target production: 400-450kg milk solids per cow per year

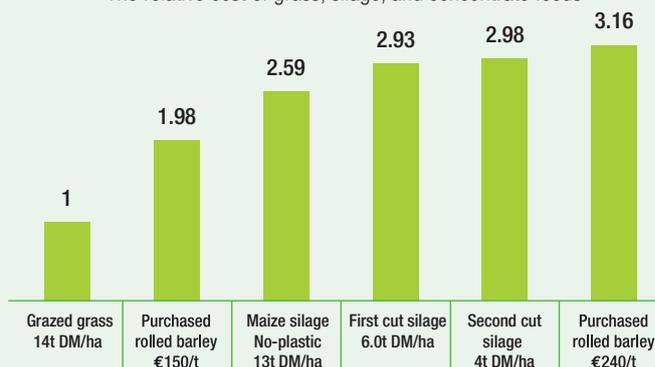


Key performance indicator



A 10% increase in grazed grass in the feeding system will reduce the cost of milk produced by 2.5 cent/litre.

The relative cost of grass, silage, and concentrate feeds



Key fact



Grass-based systems are more robust in times of price volatility. High input systems can generate more profits at a high milk price but are more exposed to the risk of lower profits at lower milk prices.

FORAGES	Grazed grass	Grass silage 1st cut	Maize Silage	Whole crop cereal silage	Brassica crops (kale, rape, fodder beet)
Utilisable yield potential t DM/ha	12-15	5-6	12-15	11-12	Kale 6.5-9.5 Fodder beet 8.5-10.5 Rape 2.5-4.0
Typical feeding value UFL	0.9-1.08 (75-85 DMD)	0.72-0.76 (65-68 DMD)	0.75-0.80	0.75-0.80	1.05-1.12
Crude protein %	16-28	11-12	7-9	7-9	5-22
Intake potential Dry cows kg DM	12-15	10-12			Can constitute up to 60-80% of DMI of the dry cow.
Milking cows	8-10 kg DM (one) week post calving, Increase by 1kg DM / week until peak at 16-18kg DM	8-10 kg DM as sole forage, decreases as grazed grass intake increases	Alternative forages will increase total dry matter intake by 15-20%, compared to grass silage only		Inclusion in milking cow diet should be restricted to 20% of DMI
Role in spring calving herds	Constitute 70% of feed budget at SR = 2.5	Primarily used for dry cows, utilisation in the diet of the milking cow should be minimised/ eliminated	Limited use, except with high stocking rates on the grazing platform and/or fragmented farms or autumn calving herds		Suitable on free draining soils. Grazing in the field can reduce feed costs as well as housing costs

* Rolled Barley has a UFL of 1.0

