



Hybu Cig Cymru
Meat Promotion Wales

Feeding the ewe for lifetime production

Taking theory ... into practice



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Correct feeding is the key to more and better quality lambs per ewe. Correct nutrition, from as early in life as an embryo or even an egg can have a substantial effect on a sheep's lifetime performance.

This guide pulls together the latest information on sheep nutrition and identifies when supplemental strategies and products are most likely to give a positive financial return.

Breeders use Estimated Breeding Values (EBVs) to sell lifetime genetic productivity but to get that lifetime performance sheep must be properly fed. Getting this right benefits those breeding replacements and their clients.

This booklet provides essential information to help achieve improved lifetime production and presents the theory and latest research findings alongside practical guidelines to enable you to put the theory into practice in your flock.



Replacement stock targets

Replacements

Lambing percentage and stocking rate account for most of the variation in gross margin between farms and hence potential profitability. Increasing production from one to two lambs per year reduces the energy requirement/kg of carcase produced by around 40% and this contributes to a reduction in costs.

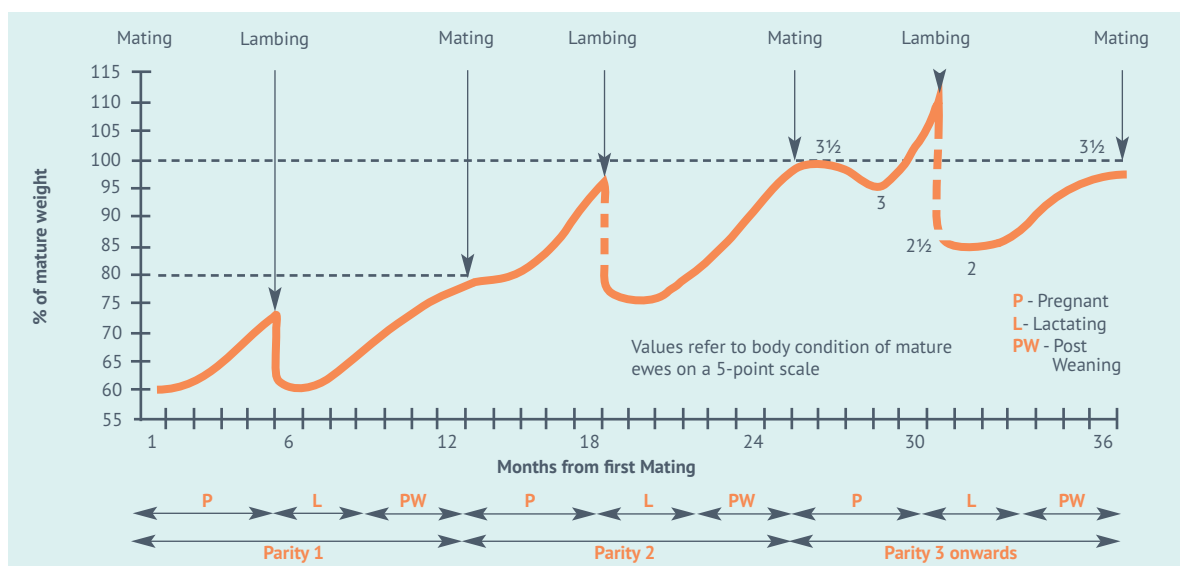
A useful target is: 1kg of lamb sold or retained / kg ewe mated

For example, a Mule ewe weighing **75kg** can produce on average **1.7 lambs** weighing **45kg** each. With the UK average lambing percentage sitting at only **120-130%** there is room for improvement. To achieve this improvement:

- Ewes should be more prolific
- Lambs must survive to sale or retention
- Ewe liveweight must not be excessive
- Nutrition is the driver

Targets for rearing replacements

Ewe replacements should be reared well and to targets if they are to be good breeding sheep. Liveweight targets based on reaching 60% of mature body weight (MBWT) at mating as a ewe lamb (7 months) or 80% as a two-tooth (18 months) have proved useful.



Breed	MBWT (kg)	Weight at first mating (kg)	
		7 months	2- tooth
Brecknock Hill Cheviot / Welsh Mountain	55	33	44
Lley	60	36	48
Welsh Mule	65	39	52
Terminal X Mule	80	48	64

Nutrition and genetics

Sheep adapt to periods of little food or plentiful food by switching on and off the genes for growth so the final animal you produce is the result of the interaction between nutrition and genetics.

Correct nutrition + good genetics = optimum performance

MBWT – Mature body weight. The mature weight of the ewe is important for accurately predicting the requirements for her growing lambs.

Replacement stock targets on your farm

Growing your own replacements

- Target weight for mating as a ewe lamb = 60% of MBWT
- Target weight for mating as two-tooths = 80% of MBWT
- It may be advantageous to use an EID linked weigher to identify ewe lambs at weaning that are more than 10% below the average weight for the mob (weigh singles and twin reared lambs separately). These ewe lambs will produce 5% less lambs even if they catch up weight by tupping.

Lambs need to grow without check to weaning; a 10% reduction in growth will permanently reduce adult prolificacy. Poor growth due to an upland/hill environment means that puberty may not be achieved in the first autumn or reached below target weight.

- Good lowland farms selling finished lambs off grass can produce ewe lambs that are capable of breeding in their first year. Quantity and quality of grazing from August is the key. Lambs on the best quality grass should gain around 120–150 grams per day (g/d); with high sugar grasses this might increase to 200g/d and with white clover-rich swards 225g/d.
- Lambs holding to first oestrus is a good indicator of further high lifetime performance. If breeding your own replacements, mate 15-20% more ewe lambs than you need and select only those holding in the first 17-21 days.
- Producing early lambs using supplementary concentrates increases fatty deposition in the udder of ewe lambs which compromises their potential future milk yield. In this situation it is better to buy in replacements from a respected source rather than risk buying ewe lambs that have been fed unnecessarily high levels of concentrates.
- Later lambing and upland farms that produce finished and store lambs off grass are a good source of breeding replacements. These are generally best left unmated in their first year and need careful management to ensure a target 80% of mature body weight is reached by mating as two-tooths.

Feeding lambs to be mated at 18 months

- Crossbred lambs under 30kg by September are too small for breeding; finish these quickly on concentrates or other finishing rations.
- In their first winter, lambs chosen as replacements need to gain about 50g/day – around 5kg over the winter. If they gain no weight over the winter they are less able to respond to flushing in later life.
- Housed hill breed ewe lambs will usually need around 135kg of hay and 25kg of concentrates for the winter or 300kg of baled silage at 30% dry matter and 22kg of mineralised barley or oats.
- In the spring, shear as early as weather allows and give access to the best grass available on the farm after shearing when appetite is high – it really is important to do these replacements well - if left too late the body weight target can easily be missed.



Prolific breeds

The science of fertility in new breeds

Fertility in sheep is thought to be influenced by hundreds of genes all with a small effect. However there are some major genes that affect prolificacy. Some of these have graded effects on a trait – eg. a ewe having inherited the 'Booroola' allele for prolificacy from both parents is more prolific than a ewe inheriting it from only one parent, and it in turn outperforms an animal that did not inherit the allele from either parent.

A notable exception to this – termed 'Heterozygote advantage' – is seen in other genes that have major influences on prolificacy in sheep, including the 'Inverdale'. In this case, ewes that have inherited an allele for prolificacy from one parent only (heterozygous carriers) are more prolific than homozygous non-carriers but homozygous carriers are infertile. Here, instead of graded effects on a trait, one copy is enough but two is too many – nature's way of regulating prolificacy. In these cases careful management of ewe and ram pairings is important. Among the breeds of sheep noted for Heterozygote advantage-style prolificacy are the Belclare, the Cambridge, and the Inverdale Texel and its cross with the Welsh – the Aberdale. The Aberdale and its crosses have been closely controlled and blood typed so that one copy of the gene for high prolificacy will be in all ewes and none have two copies, but in the other breeds the incidence of these genes is unknown, theoretically it will be in around 10-20% of ewes.

The Lleyn breed is noted for its prolificacy, giving rise to the Belclare and Cambridge sheep, both of which are known to carry more than one major gene affecting prolificacy. Two of the 3 mutations implicated in the prolificacy of these composite breeds have also been identified within the Lleyn breed itself and at least one study showed a 15% incidence of Lleyn ewe lamb infertility consistent with the 'one is enough but two is too many' allele scenario. It is also possible that many Lleyn flocks contain no major genes for fertility.

Homozygous – Carrying two identical alleles for a single trait

Heterozygous – Carrying two different alleles for a single trait – one of the alleles will be dominant

Graded effects – Two copies are better than 1, 1 copy is better than none

Heterozygous advantage – One copy of the dominant gene is better than none or two copies

“correct management is essential to ensure your chosen breed achieves its potential”



Mating management for prolific and traditional breeds

Mating management for prolific and traditional breeds

A “one size fits all” approach to ewe nutrition at mating is not applicable to prolific breeds and these breeds should be managed appropriately to produce the optimal number of lambs to meet your particular breeding goals.

Prolific breeds



Lleyn – Mate Lleyn ewes on short swards



**Cambridge – High litter size puts pressure on management*



Aberdale – Should be put onto low quality pastures pre-mating releasing better grass for lamb finishing

Traditional breeds



**Welsh mules – Target condition score 3.5 for mules*



**NZ Romneys – Respond well to flushing*



**Welsh mountain – Wean in August to allow ewes time to regain condition*

**Photos courtesy of British Wool Marketing Board*

Nutrition around mating

Ewe lambs that reach 60% of mature weight by mating will have good body condition that encourages follicle development on the ovary and sets the potential lamb crop. However overfeeding pregnant ewe lambs just after mating can reduce lambing % due to effects on progesterone supply and should be avoided. Research suggests that mild overfeeding during mid to late gestation has little effect on foetal growth, postnatal lamb growth, hormone concentrations and carcass characteristics, but if it results in overfatness then lambing difficulty will increase.

Effects of feeding in days 0-40 on ewe lambs (AFBI Hillsborough NI)

Value	Feeding level in early pregnancy		
	High (2M)	Moderate (M)	Low (0.6M)
Weight at tupping (kg)	45	43	44
Change in body weight over 40 days (kg)	+5	+3	-1
Conception rate to 1st service (%)	38	51	61
Weight at lambing (kg)	60	56	54
% ewes helped to lamb	87	52	48
Lamb birth weight (kg)	5.3	4.6	4.5
Lamb mortality at birth (%)	6	7	14

M= Maintenance level of feeding

The results of this study confirm earlier observations with embryo transfer studies that ewe lambs, but not mature ewes, are sensitive to high nutrient intakes post mating.

Allowing adolescent ewes to lose moderate amounts of liveweight and body condition during the first month after mating can increase the proportion that successfully conceive. However, if this restriction is over done then the ewe lambs are less capable of sustaining high levels of lamb performance from birth to weaning, offsetting the fertility benefits for lamb output.

While it may be tempting to feed a high plane of nutrition to increase body size, overfeeding in mid-pregnancy (gaining 2kg/week) restricts placental development and this can result in the birth of small lambs with poor viability. Overfed ewe lambs spend less time interacting with their lambs and are less willing to facilitate suckling. Ewe lambs that gained 1kg per week had normal lamb birth weight and behaviour so a moderate gain of 10 -15kg including the weight of lambs, placenta and fluids from a month after tupping to lambing (0.75- 1.0 kg/week) would seem a sensible target.

Progesterone levels govern placental development

Progesterone is the key hormone influencing the generation, establishment and performance of the placenta and its ability to support foetal development. Adequate amounts of progesterone are needed in the fortnight immediately after conception otherwise the viability and liveweight of the lambs will be compromised.

High feed intake increases blood flow through the liver and increases the rate at which progesterone is lost; this compromises the development of the lamb. Ewes with major prolificacy genes ovulate more eggs but they have less effective progesterone-producing capacity and this is why flushing these ewes should be avoided.

Progesterone is secreted by the corpus luteum in the ovaries after ovulation and prepares the uterus for pregnancy and the mammary glands for milk production. Progesterone levels are determined by the ewe's ability to produce it following ovulation and by the rate at which it is lost by breakdown in the liver.

Managing nutrition around mating

Mature sheep should be at the optimum condition score for mating. Set the ewe's targets for growth and body condition in the months before mating so that there is no need for dramatic 'catch-up' feeding during the time that ewes are with the rams or in the months that follow.

Achieving condition score targets:

Putting on one unit of condition score adds 13% of liveweight so to go from CS 2 at weaning to CS 3.5 at mating, a 65kg ewe has to put down about 13kg, mainly as fat.

- The energy content of the weight gain is 24 MJ/kg.
- On reasonable diets the efficiency of gain is about 45%, so the ewe needs to eat about 55MJ per kilo gain – about an extra 700 MJ in total.
- Over 10 weeks this is 10MJ/day – equivalent to 1kg of concentrates/day or an extra kilo of DM of best quality grass.
- For thin ewes or if swards are too short (<4 cm) or brown due to drought (rather than green) or where heavy rainfall interferes with grazing, then feed around 0.5 kg/day of cereal/beet pulp mix using a snacker to minimise grazing disturbance.

Do you need to flush?

- Flushing traditional breeds that are already fit in terms of body condition won't stimulate the ovaries to release even more eggs for fertilization but there is a place for traditional 'flushing' where adult sheep have missed the condition score target due to bad weather or feed shortage.
- Avoid flushing and heavy feeding around mating for breeds that carry prolificacy genes eg. the Lleyn, Cambridge, Belclare and Aberdale.

Missed the target weights?

If lambs are mated at under 60% of mature weight they can safely gain 80-140g/day in pregnancy (8-15kg in total) which includes weight of lambs, placenta and fluids.

- To reduce a ewe lamb's condition score from 3 to 2.5 from tugging to lambing, graze them on swards 4-6cm high;
- Allow lambs to grow frame during pregnancy with a target CS at lambing of 2.5-3.0 for an easier lambing;
- Condition score ewe lambs 5 weeks pre-lambing;
- Give twin bearing and thin ewes (CS less than 2) an extra 150 g/day of soya or access to buckets (200g/day) that are designed to increase the supply of microbial and digestible undegraded protein (DUP);
- Don't allow them to rear twins; cross-foster if possible.



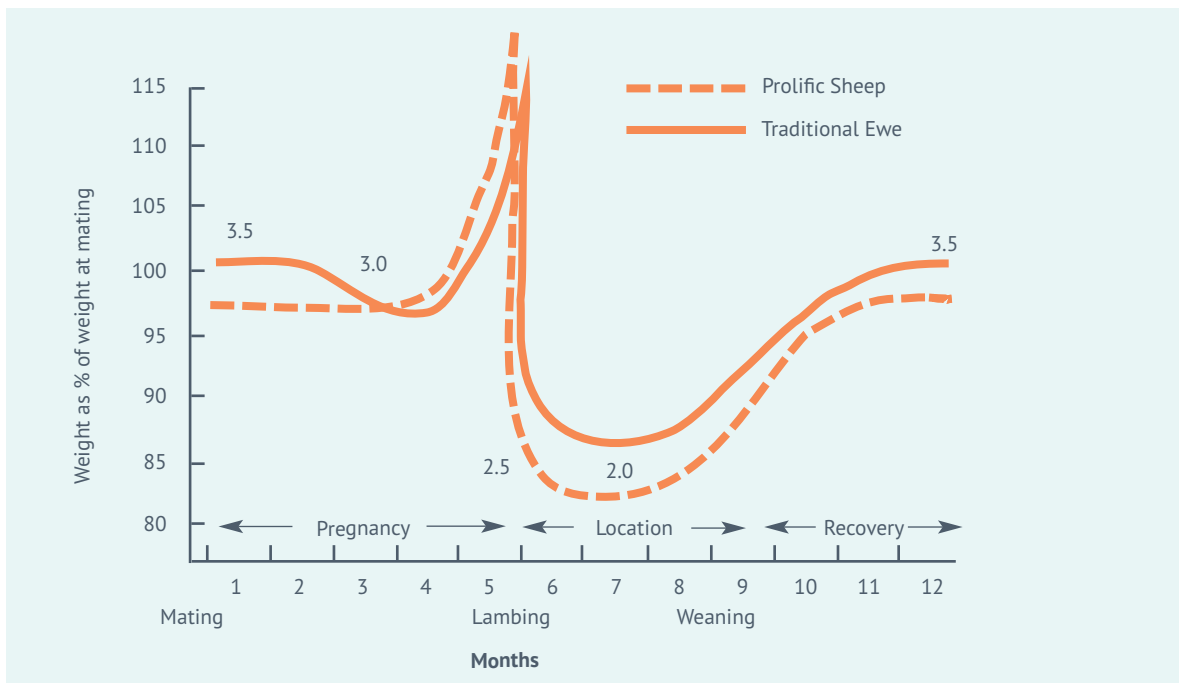
Managing lambing percentage

Synchronised and/or superovulated sheep

Nutritional flushing is not applicable to ewes being stimulated artificially to produce higher numbers of embryos because the ovaries of the ewe will be influenced more by the injections than by 'nutritional flushing'. In particular, if synchronisation depends on an intravaginal progesterone-releasing device such as a sponge then the timing of ovulation depends on a fall in progesterone following device removal. Over-generous feeding while the device is in place increases the blood flow through the liver and this lowers progesterone concentrations. This can limit the number and quality of embryos generated.

Prolific ewes need different treatment

Farmers will be familiar with the classic liveweight and 'body condition change' pattern (solid line) shown below. Mature prolific ewes carrying more than two lambs (broken line) do not follow the classic pattern.



Prolific ewes should be held at CS 3 during early pregnancy and the traditional "flush and fall" scenario should be avoided. Ewes bearing multiples will tend to be heavier pre-lambing and lighter post-lambing. If lamb survival is good (and especially if rearing all her lambs) the ewe is likely to lose more weight during lactation. Consequently, she will be tugged at a lower body weight and CS and faces an uphill struggle to hit conventional targets at tugging. She needs to be managed so that she reaches CS 3 again 1 month before tugging. Prolific breeds that produce more than enough eggs can be in optimum condition for mating below CS 3. Hence the recovery period can extend into the subsequent pregnancy and by having thinner ewes this will reduce triplets and quads.

Condition score targets

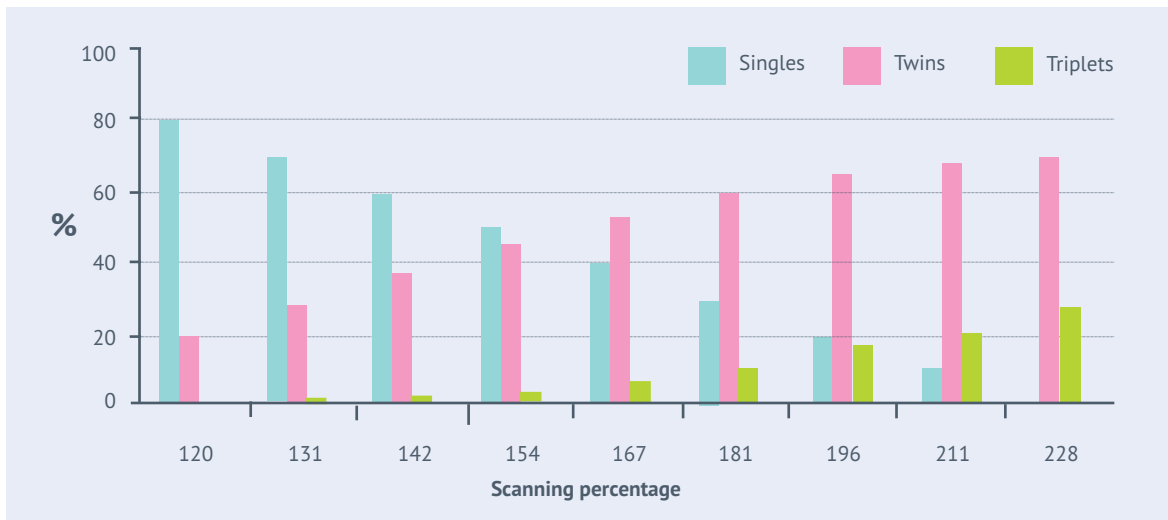
Breed	Weaning	Mating	Mid-pregnancy	Lambing
Hill / Upland	2.0	2.5 - 3.0	2.5	2.0 - 2.5
Lowland	2.0	3.5	3.0	2.5
Prolific	2.0	2.5 - 3.0	2.5	2.5

Managing lambing percentage in prolific ewes

Increasing the number of lambs born is only worthwhile if the ewe can rear the additional lambs. Triplet and quadruplet births are generally unprofitable where lambs have to be reared off the dam. Surveys suggest that on average farms mortality levels to weaning amongst singles are around 5% versus 10% amongst twins and up to 30% in triplets.

Controlling the incidence of triplets and quads by nutrition at mating is a good start.

Distribution of multiples as scan percentage increases



Hence, Lleyn and Aberdale ewes can achieve over 200 lambs born per 100 ewes easily without flushing. Studies on Aberdale (Inverdale Texel X Welsh Mountain) ewes showed that grazing on low quality swards of native grasses at a pre-tupping sward height of 8cm rather than perennial ryegrass /clover kept 19 of 26 flocks in the desired lambing percentage range (160-200%).

Both Lleyn and Aberdale ewes are also well-suited for later-season lamb production when they scan around 10-20% lower.

What to aim for:

- The target condition score at 3-4 weeks pre mating is 2.5 for prolific ewes
- Hold them at this level to one month post tupping
- Typically sward heights of 4cm are fine or use mature pasture
- Supplement mature pasture with trace elements
- Avoid stress from extremes in weather by providing adequate shelter and reduce any unnecessary handling
- For mating on forage brassicas allow 50g/day intake of a feed block containing 40mg/kg Iodine



Trace elements and reproduction

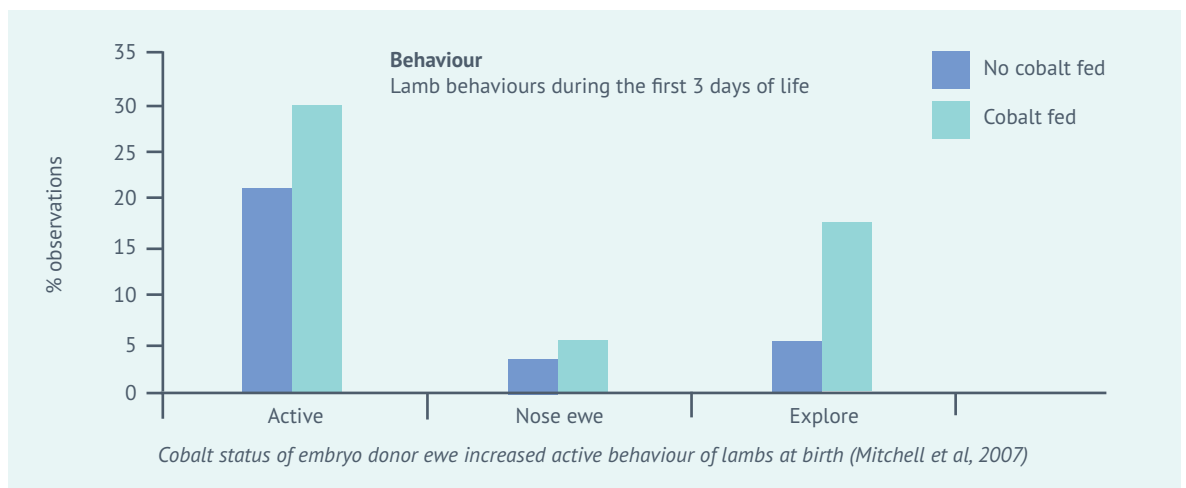
Specific effects of cobalt - early stages

Cobalt (Co) is a key nutrient during oocyte (egg) development and for the early foetus. However its effects on lamb vigour at birth are not seen until much later and long after any remedial action can be taken. In trials involving Scottish Blackface ewes from farms with cobalt-deficient pasture the cobalt status during egg production and embryogenesis was found to have a major long-term influence on lamb behaviour.

Studies of lambs from ewes which were deprived of cobalt and sulphur during the very early stages of egg production and embryonic development (ie from 8 weeks before conception to 6 days after conception) showed that while there were no effects on pregnancy establishment or birth weights there were long-term effects on the offspring including:

- More fat and lower muscle: bone ratio
- Less effective immune responses
- Insulin resistance
- Elevated blood pressure

Cobalt given before mating affects lamb behaviour



Selenium supplementation pre mating

There is positive benefit from supplementing with selenium (Se) but the extent of the problem needs to be established well before the start of the breeding season (i.e. if required rams need treatment 12 weeks pre-mating, ewes 6 weeks). Where Se levels are low, supplementation will help to reduce the number of barren ewes and increase the number of lambs born. Lambs will be livelier and can be as much as 0.6kg heavier at weaning. The effects of poor Se levels on the lambs are often long lasting and can last for weeks or even years.

Vitamin E levels in late pregnancy

Vitamin E supplementation during late pregnancy generally improves lamb vigour. Ewes will mobilise their own reserves of vitamin E from their fat if needed, but since these body reserves are not known it is wise to provide 80-100mg Vitamin E/per day during late pregnancy – particularly for ewes lambing outdoors at lower condition scores.

Early stage development

The very early stages of egg production and embryonic development occur from around 8 weeks before conception to 6 days after conception. Ewe nutrition during this period not only has a marked effect on the resulting lambs but the effects also tend to be long-term.



Providing your ewes with adequate trace elements for reproduction

Identify the problem - do you have a trace element deficiency?

If scanning rates are low and lambing spread out despite having good liveweight gain and condition scores, have forage, soils and blood or tissue tests done to identify trace element deficiency. Many companies will test forages for free for major and trace elements which provides a useful starting point. There are many trace element products available for treating Co and Se deficiencies so use all sources of information possible in your supplementation decision and discuss results with your vet.

Use the table below to plan tissue sampling.

Cobalt	Clinical signs	When to sample	Number to sample
Copper	Swayback Ill-thrift (uncommon)	<ul style="list-style-type: none"> Ewes pre-tupping (useful if results are within or below marginal band) Lambs at weaning Cases of ill-thrift 	Blood: 7-10 (heparin samples best, clotted OK) Liver: 3
Cobalt	Ill-thrift Poor fertility Neonatal losses	<ul style="list-style-type: none"> Ewes pre-tupping and pre-lambing Lambs at weaning Cases of ill-thrift 	Blood: 10 (clotted samples) Liver: 3
Selenium	Ill-thrift, poor fertility High barren rate Stillbirths White muscle disease	<ul style="list-style-type: none"> Tups and ewes pre-tupping Ewes pre-lambing Lambs at weaning Cases of ill-thrift 	Blood: 3-5 (clotted samples) Liver: 3
If you have: <ul style="list-style-type: none"> A history of scanning percentages which are below target Thin sheep Feed supplies which are sparse at tupping (e.g. late lambing) Feed supplies which are of low quality 		Do use high energy, high intake (200-300g/day) type feed blocks. These can give a 10-20% increase in lambing percentage but the minimum Co and Se content of these needs to be 1.2mg/kg and 0.8mg/kg, respectively. Don't use anthelmintic products containing trace elements to address production problems, trace element levels may not be sufficient to redress the balance and you increase the risk of encouraging drench resistance.	
For prolific sheep and well grown ewe lambs at mating, where no extra energy and protein is needed:		Do – consider minerals/mineral blocks or low intake hard licks to supply Co and Se (minimum levels in licks with an intake of 30-70g/day are 6mg/kg and 3.6mg/kg respectively). Don't – buy supplements on the basis of high phosphorous and digestible undegraded protein (DUP) levels, they are not necessary.	

If you do need to supplement:

- Select the most appropriate supplement;
- Train young sheep to take minerals in the format used;
- Set up one site per 30 ewes to avoid stress around tupping;
- Keep supplies topped up;
- Start two weeks before ram turnout and feed for a further month;
- Have only one source of supplementary minerals – multiple sources can oversupply iodine to the pregnant ewe affecting colostrum absorption by the lamb.

Pregnancy to 90 days

Under-nutrition effects on lifetime performance

In the first half of pregnancy, while various organs and processes are being established in the growing foetus, under-nutrition can have a permanent effect. Work on hill ewes has shown that under-nutrition of foetal ovaries limited litter size in later life when the foetus itself became a breeding ewe. Permanent effects from under-nutrition on muscle growth, cardiovascular development, endocrine glands (implicated in reaction to stress), the immune system and brain development have also been found.

Effects of underfeeding energy and protein on foetal development and mother-offspring interactions

Studies on underfed ewes using ultrasound and video surveillance of ewes and lambs at lambing and testing the ability of lambs to recognise their mothers at 24 hours old showed:

- Reduced foetal growth and birth weight;
- Poorer quality of maternal care to their offspring;
- Lambs less vigorous at birth with higher mortality;
- Reduced birth weight in some breeds;
- Effects on lamb behaviour and survival;
- Underfed ewes groom and bleat to their lambs less immediately after birth and scored lower in tests of maternal attachment.

Longer term effects of under-nutrition (e.g. on reproduction and health, as well as trans-generational effects) are currently being investigated.

Effects of underfeeding energy and protein on the placenta

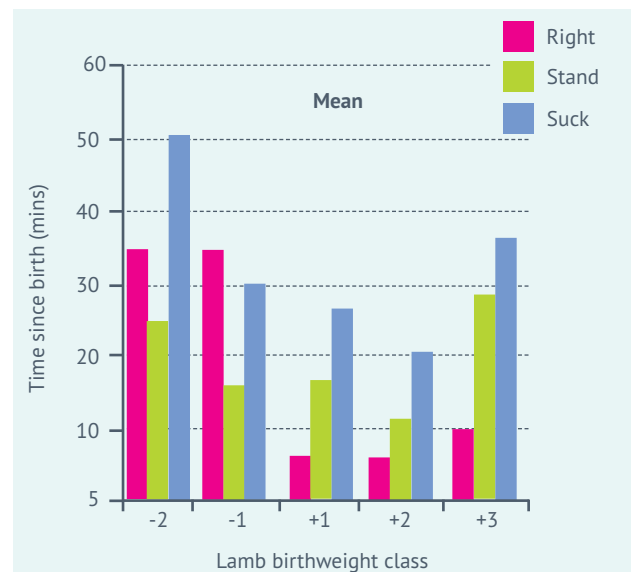
In general, a moderate mid-pregnancy 'check' in terms of feed intake can favour the mature ewe's inclination to invest resources in the placenta with a subsequent pay-off in terms of good lamb birthweights. This capability – which is absent in the 'need-to-grow' adolescent ewe – may reflect evolutionary adaptations to cope with winter snowfall scenarios in mid-pregnancy.

Remember – nutrition affects each stage of development independently.

The impact of inadequate nutrition at each stage of development often has permanent or long-lasting effects in the lamb.

If nutrition is inadequate at one stage the damage cannot be undone by heavy feeding later.

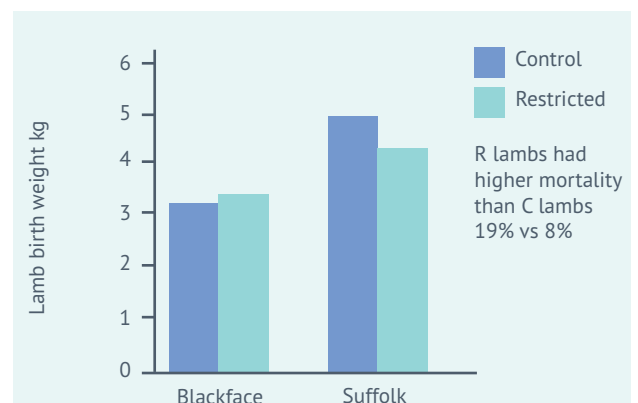
Under-nutrition and lamb behaviour



Low birth weight lambs take longer to stand and seek the udder than heavier lambs. Optimal birth weight improves lamb vigour.

Right - refers to when the lamb shakes its head and sits up just prior to standing.

Effects of undernutrition - lambs



- Suffolk lambs, lighter at birth when feed was restricted
- Lambs less vigorous at birth (e.g. % assisted to suck) and less active during development
- Suffolk ewes and lambs were seen further apart during lactation
- Lambs less able to recognise their mothers in tests

R lambs had higher mortality than C lambs 19% vs 8%

Managing pregnancy to 90 days in your flock

Aim to maintain body condition and avoid stress for the first month after mating and whilst rams are running with the flock. In stressful conditions ewes will reabsorb embryos and end up barren despite having been mated.

Avoiding stress:

- Stress can be caused by sheep fighting for feed from a trough so avoid daily supplementation if possible;
- Heat stress kills embryos so avoid sheep being run to exhaustion;
- Avoid weather stress by using sheltered fields;
- Do not gather sheep to the ram, if he is any good he will find them.

Avoiding under-nutrition

Severe under-nutrition causes problems but most lowland ewes should have sufficient body reserves to avoid this. Thin hill ewes can be supplemented with a hard type feed block/lick and 0.6kg of hay (30 ewes/bale) in snowy conditions.

In the second and third months from mating ewes can be allowed to lose half a body condition score and may benefit from mild under-nutrition. Ewes can be scanned at 80 days onwards for litter size.

Don't overfeed lowland ewes, prolific breeds and ewe lambs

Graze either short leafy swards at around 4cm or old pasture but check that cobalt levels are adequate. If cobalt is a known problem treat the ewes with cobalt bullets or if there are multiple deficiencies use a bolus. Blocks or licks may suffice but do not rely on oral drenching or the cobalt in a wormer.

Pregnancy timetable for timing of management tasks

Day	Events	Key Stages	Management Tasks
0	Mating	Pre-implantation	Avoid stress and handling ewes
3	Fertilisation		
15	Migration	Implantation	
34	Implantation		
40	Foetus weighs 5g	Placental Growth	Embryos now 'safe'
90	Foetus weighs 700g		



Feeds that can affect breeding efficiency

Some feeds can impair breeding through the effects of plant secondary metabolites. These are plant components that have chemical structures that are similar to the hormones that control reproduction in the animal.

Red Clover

Plant breeders are trying to reduce the concentration of formononetin, the major oestrogenic factor in red clover varieties. Formononetin in red clover is converted to phyto-oestrogen in the rumen and has been shown to cause infertility in sheep. Making silage from red clover concentrates the oestrogens and makes the problem worse.

White clover however, as a grazed crop or silage, is safe.

Forage brassicas

Forage brassicas contain goitrogens that prevent iodine uptake by the thyroid so where they are fed for long periods supplementation with iodine is beneficial. Another metabolite, S-methyl cysteine sulphoxide may cause the breakdown of the red blood cells which carry oxygen around the body (haemolytic anaemia). Plant breeders have reduced the concentration of harmful metabolites so by controlled use of forage brassicas around mating and providing access to other feeds such as grass the problem is usually avoided.

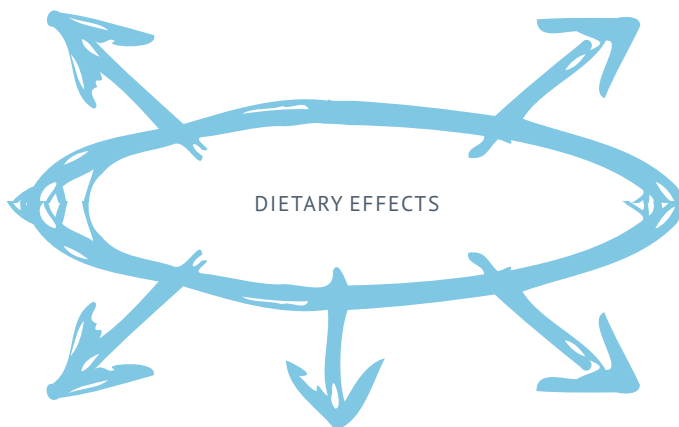
Beneficial effects on reproduction

However, some plants may have beneficial effects on reproduction if fed around mating time. For example, chicory is high in trace elements and evidence suggests that the condensed tannins that chicory contains may inhibit or reduce worms. Early indications are that it is useful for ewes and rams pre-mating.

Feeds and feeding that can impair breeding efficiency and give low lamb numbers.

GOITROGENIC FORAGES
e.g. Kale and rape

OESTROGENIC FORAGES
e.g. red clover



MYCOTOXINS IN LOWEST SWARD LAYER

VITAMIN E/SELENIUM DEFICIENCY

HIGH FEEDING LEVELS THAT DEPRESS PROGESTERONE

Chicory is high in trace elements and reduces worm burdens and suggestions are that it is useful for ewes and rams pre-mating.



Oestrogenic factors – compounds which are structurally similar to oestrogen and can either compete with or mimic oestrogen thus reducing the effect of the oestrogen and cause infertility.

Goitrogens – compounds which inhibit the synthesis of the thyroid hormones thereby reducing the output of these hormones. Some goitrogens reduce or inhibit the uptake of iodine.

Tannins – plant compounds that either bind to or shrink proteins and various other organic compounds. Tannins are widely distributed in many species of plants, where they play a role in protection from predation and may also be involved in growth regulation.

How to avoid problems with feeds that can impair breeding efficiency

Forage brassicas

Forage brassicas contain goitrogens that prevent iodine uptake by the thyroid. Symptoms of goitre are swollen thyroid glands in the neck.

Other metabolites may cause haemolytic anaemia and thyroid damage. Anaemic sheep are lethargic and have pale mucous membranes.

- Look out for these symptoms as problems are rare;
- Use kale at least part-time for flushing and tupping leaner ewes and gimmers in later lambing flocks. *Avoid this for fit ewes and very prolific breeds.* Kale made into silage loses its toxicity;
- Ration the crop and introduce it gradually on and off for 3-4 days then full time or one day on and one day off, but avoid putting sheep onto frosty kale;
- Have a run back with grass or provide straw;
- Supplement brassica crops fed during tupping or in pregnancy with blocks/buckets containing iodine or give iodine injections.



Red Clover

- Don't feed swards with over 30% red clover to ewes or rams 45 days either side of tupping;
- Don't feed red clover silage after tupping – it will result in barren ewes and undersized lambs;
- Silage made from red clover can be fed safely in the last third of pregnancy;
- White clover as a grazed crop or silage is safe but plants stressed by insect or fungal infections can have elevated phyto-oestrogen levels, so avoid stressed crops with breeding sheep;
- The recent red clover variety AberRuby has lower phyto-oestrogen content;
- Feeding lucerne or red clover to ewe lambs over a prolonged period could be detrimental to their long term reproductive ability and should be avoided.

Do you know what your replacements have been fed?

Many farmers are moving to rearing their own replacements for a variety of reasons including biosecurity and the need to bring in high performance and easy care traits. These traits are often ignored by many traditional breeders who base sales on looks.

Farmers buying in replacements as ewe lambs or gimmers tend to pay more for the biggest ones; this is not a sensible strategy if the nutritional basis of this has been heavy supplementary feeding just prior to sale. All this does is mask inefficient grazing and/or worm resistance.

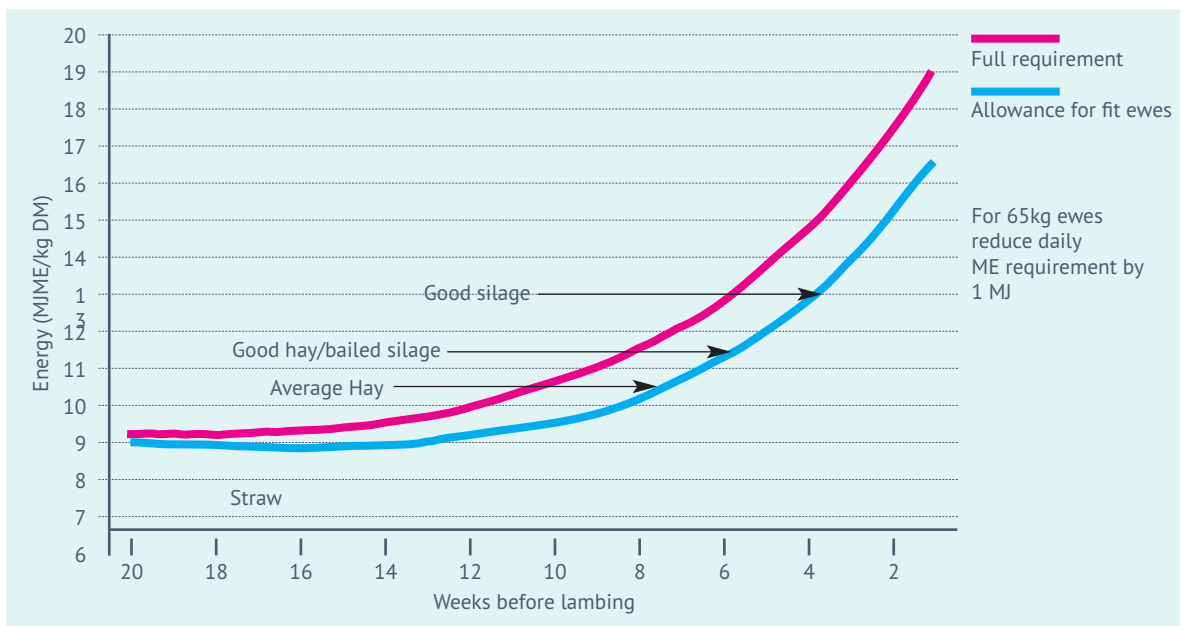
If you buy in replacements, ensure that they come from a respected source. By rearing sheep correctly longevity is increased; all farmers agree that sheep with longer productive lives are needed.

Late pregnancy

Having looked at feed requirements at mating (pages 6-11), during very early pregnancy and up to 90 days (pages 12-13), any changes to feeding management during late pregnancy (4-5 months) should be based on pregnancy scanning at 80 days and body condition scoring 8 weeks before lambing.

In months 4 and 5, providing the ewe was in good condition at mating (3.5) and is now around 3, another 0.5 of a condition score can be lost without affecting foetal growth to achieve a score of 2.5 at lambing. This provides reserves for lactation and insulation while helping to reduce the incidence of lambing difficulty. Ewes that are underfed in late pregnancy produce lambs with low reserves of brown fat used specifically for protection against hypothermia. In late pregnancy the ewe adapts to rumen restriction by increasing the food passage rate and increasing protein absorption by 15%. A high energy content (at least 12.5 MJ ME/kg DM) in the concentrate is critical as the ewe eats less.

Energy requirements of pregnant 75kg twin bearing ewes



Cereals and cereal by-products are a good source of energy but high levels of cereals, particularly wheat, can cause acidosis so the inclusion of a digestible fibre source, such as molassed sugar beet pulp at around 20% is desirable. Cereals can be fed whole with hay but should be lightly processed with silage. The inclusion of molasses will provide readily available energy, aid palatability and will reduce dust and carry minerals.

Protein is required for lamb growth and colostrum yield and quality. Rumen microbes also need a sufficient supply of effective rumen degradable protein (ERDP). In late pregnancy the concentrate should also provide digestible undegradable protein (DUP), which is resistant to breakdown by the rumen microbes and is digested in the small intestine. The UK uses the metabolisable protein system for estimating protein requirements for maintenance, production, immunity and body reserves. Sheep get their metabolisable protein from both microbial and bypass protein. Normally microbial protein provides most of the requirements but for pregnant and lactating ewes, microbial supply only meets 60–70% of the supply, the rest coming from digestible undegradable protein (DUP) also called bypass protein.

Rumen degradable protein – protein which can be broken down and utilised by rumen microbes. Microbial protein can then be absorbed by the animal when it passes into the small intestine.

Digestible undegradable protein – proteins that have a slow rate of degradability and escape digestion in the rumen. The undegradable protein is then broken down in the gastrointestinal tract as it would be in non-ruminants.

Mannan oligosaccharides – are normally obtained from the yeast cells and are widely used in animal feed to encourage gastrointestinal health and performance.

Feeding during late pregnancy

In late pregnancy rations may be based on straw, average or good quality hay or silage. Hay and silage can be very variable in their nutrient content and so it is essential to have forages analysed well before this period so that rations can be formulated and the amount and type of supplement required can be determined. Daily forage dry matter intake (percentage of liveweight) is shown in the table below.

Daily dry matter intakes as % of ewe liveweight by twin bearing ewes in pregnancy and lactation when fed concentrates

	ME	Weeks 12-3 pre lambing	Weeks 3-0 pre lambing	Weeks 0-3 of lactation
		% of LWT	% of LWT	% of LWT
Straw	6.5	1.0	0.8	n/a
Average hay	8.5	1.5	1.1	1.2
Good hay	9.5	1.8	1.4	1.5
Poor silage	9.5	1.4	1.2	1.3
Good silage	10.5	1.6	1.4	1.6

For example, the graph opposite shows that a 75kg ewe just before lambing needs 19 MJ ME/day. The table above shows that if you are feeding average quality hay she is able to eat **1.5%** of her liveweight.

1.5% of her bodyweight = 1.13kg.

To calculate how many MJ of energy this will supply multiply by the ME of the feed
e.g $1.13 \times 8.5 = 9.6 \text{ MJ}$

If she needs 19 MJ ME/day then to calculate how much concentrates to feed; $19 - 9.6 = 9.4$
A good quality concentrate has an energy content of approx **12.5** MJ/kg of dry matter and the dry matter is **86%**

Therefore each ewe needs:

$$\frac{9.4 \times 100}{12.5 \times 86} = 0.9\text{kg/day}$$

Choosing a compound feed

- Do work out what the nutrient content of your forage is first so that you know what type of compound feed you need;
- The minimum metabolisable energy (ME) in a compound should be 12.0 MJ/kgDM and good quality ingredients should be used to achieve this with no reliance on low energy by-products;
- Do not use compounds with lower energy content because they will need to be fed at higher levels – this will reduce forage intake;
- Get your supplier to provide a full formulation and specification of the compound. The protein level should be 18%CP, but this gives no indication about the protein quality (ERDP & DUP). The formulation will provide this information and will show the source of energy being used – cereals, maize gluten, sugar beet pulp, soya hulls;
- Avoid formulations with low quality ingredients such as oatfeed, olive pulp, shea nut, cocoa shells or coffee residues;
- For DUP content Hipro soya is the best natural protein source. It has 245g DUP/kg DM when fed in late pregnancy. When browned it produces a product with 310g/kg DM. Alternative chemical treatment produces a product with 430g/kg DM, this is the highest currently available;
- Other protein sources provide lower amounts of DUP; dark grains provide 130g/kg DM, rapeseed meal provides 90g/kg DM with beans only 40g/kg DM;
- Supplementary feeds with mannan oligosaccharides (MOS) increase colostrum quality.

Monitoring nutritional status and supplying sufficient DUP

Interpreting forage analyses

The key components of analysis are dry matter (DM), metabolisable energy (ME) and crude protein (CP). Current analytical techniques supply information regarding the degradability of the protein.

For silages the intake potential will also be provided with an estimate of the fermentation quality. Ideally samples should be taken from several bales and for pits, cores should be taken at several points across the diagonals of the pit to ensure that the material analysed is representative of the whole. The voluntary intake of precision chopped silage is higher than that of big bale material and ration formulation programmes should take this factor into account.

Assessment of the ration

- Is the ration on paper the same as the ration being fed? Check weights;
- Is the ration being offered actually being eaten? Check wastage, clean out troughs;
- Is there adequate trough space for all the ewes to consume their concentrate allowance at the same time?
- A useful check for diet adequacy is a blood sample for the concentration of a compound in the blood called β -hydroxy butyrate (BOHB). Discuss results with your vet to get an accurate interpretation and to work out the best course of action.

Silage with supplementary DUP for late pregnancy

Due to genetic selection we now have ewes whose protein requirements are unable to be met from microbial protein alone. Exceptionally high demands are required for multiple lambs with high lamb foetal growth rates. This can only be met from supplying additional DUP.

Silage is capable of meeting energy requirements but is a poor source of DUP. With improvements to baling technology it is now feasible to produce baled silage for sheep regularly with an ME over 11.0 MJME/KgDM. In trials where silage has been supplemented with a source of DUP such as soya, results have been similar or better than conventional concentrates but with 75% less concentrate fed and potentially lower labour costs.

Soya vs conventional supplementation (Adapted from Keady and Hanrahan 2009)

	Silage Quality ME (MJ/KgDM)		
	10.0	11.5	
Concentrate fed (kg/ewe in total) over last 4 weeks of pregnancy	20 (concentrates)	5 (soya)	20 (concentrates)
Ewe weight (kg) post lambing	61.4	70.4	73.6
Lamb birth weight (kg)	4.6	4.9	5.1
Lamb weaning weight (kg)	32.9	34.0	34.7

Other trials have shown ewes fed extra DUP in late pregnancy increased lamb litter weight (twins) by over 1.0kg compared to controls. An additional effect shown was a reduction in a ewes faecal egg count during late pregnancy, demonstrating better immune function.

Hipro soya is a good choice of a DUP source and is widely available, it has a high initial crude protein and above average undegradable fraction. This can be enhanced by browning or chemical treatment to produce a range of commercially available feed supplements (protected proteins). These have lower costs per unit of DUP and have been fed successfully with silage over 11.5 ME.

Monitoring nutritional status

Typical rations for 75 kg housed ewes

Hay to appetite (around 0.86 kgDM/d) with the following concentrate allowances (kg)

	Weeks from lambing			
	8	6	4	2
Singles	0.1	0.2	0.35	0.5
Twins	0.2	0.35	0.5	0.8
Triplets	0.25	0.5	0.7	1.0

Silage to appetite (around 1.0 kgDM/d) plus concentrates (kg)

	Weeks from lambing			
	8	6	4	2
Singles	–	–	0.25	0.45
Twins	–	0.25	0.45	0.6
Triplets	0.25	0.4	0.6	0.8

For ewes below CS 2 and with triplets feed extra concentrates or buckets.

Supplements for hill ewes

The value of supplements given to pregnant hill ewes on indigenous grazing is difficult to estimate as deficits are hard to quantify and will include minerals and trace elements.

On heather-dominant hills, extra protein supply in mid pregnancy from feeding blocks increases lamb birth weight. The cost of feeding out in time and labour has also to be accounted and supplements may affect grazing behaviour and hence overall feed intake.

Hence simple comparisons of cost per unit of ME and CP are less relevant for hill ewes than with other classes of stock.

Practical recommendations for feeding silage with supplementary DUP

- Feed 100g per day, per lamb carried, of soya bean meal for the last 3 weeks of pregnancy. This should be fed as an addition to the normal diet for thin ewes on average quality forages and as a substitute for part of the concentrates for fat ewes;
- The amount of soya bean fed should be halved if using protected soya (i.e. 50g/lamb carried/day);
- Where silage is above 11.5 MJME/KgDM then soya or protected soya can be fed as a sole supplement;
- Silages with an ME of 11.0+ can be fed with low levels of cereal (0.3kg/day) plus soya bean meal, this will not interfere with silage intake or digestibility;
- Silage intake must not be restricted by feeding arrangements (e.g. overcrowding around feeders);
- In mid pregnancy high quality silage could make ewes overfat. This effect can be reduced with straw in a TMR or by feeding only 4-5 days a week ad-lib with straw on other days;
- Good quality silage is key as it requires little cereal addition meaning less disruption of rumen pH which can reduce microbial protein supply.

All grass wintering – an option for Welsh farmers

All grass wintering, a system that involves taking ewes through the winter on rotationally grazed grass, is a relatively new concept for Welsh farmers offering significant reductions in feed cost and labour requirements.

UK trials started in 2011 in Cornwall using 950 NZ Romney ewes, subsequent trials across the UK with many breeds have identified potential for Welsh conditions. On upland Welsh farms a variation on all grass wintering involving a winter grazing rotation followed by housing for lambing may be more appropriate.

The system depends on building up a wedge of grass in the autumn for grazing after tupping, on a daily shift system of up to 1000 ewes/ha. This runs from 25 days after ram turnout to 10 days pre lambing (100-110 days) when ewes can either be set stocked at 15/ha (6/acre) or housed for lambing. Lambing outside requires winter grass growth of 10kg DM/ha/day. Where winter grass growth is 5kg DM/ha/day growth or less, ewes should be housed for lambing and prior to this supplemented with concentrates for 10 days.

The advantages of the system:

- A savings in feed costs of £10 to £15/ewe;
- Ewes become increasingly docile from being moved daily;
- Grass gets long rest, grazed once in winter;
- Have covers of 1,500kg DM/ha in spring for lambing.

Clearly this type of system is weather dependant and contingencies for adverse conditions should be made.

How the system works (ideally need to integrate with summer rotation)

- Measure grass cover in autumn by using plate meter/sward stick;
- Allocate 1kg DM/hd/day pre-scanning, with 1.5kg post-scanning;
- Calculate the area needed by the group for each day;
- Graze to residual of 800-1,000kg DM/ha pre-scanning, 1,200kg post-scanning;
- Monitor ewe condition throughout - remove ewes that are weak or thin.

Farms chosen for the project had in general dry soils and were in favourable grass growing areas, so there are only a proportion of farms where this wintering system can be used. The system rations grass to give the ewes their daily nutritional requirements when grass feed availability is tight and the alternatives are expensive. Without strict rationing there is risk of over or under-estimating what grazing provides. Under-estimation represents inefficient use of feed, and can lead to overfat ewes at lambing. If ewes have to be supplemented outside, the system can prove expensive and causes pasture damage around feeders and through tractor tracks.

All wintering ewes solely on grazed grass is feasible on coastal farms and for part of the winter on upland farms. Shift patterns of up to 3 days in length can be used depending on flock and paddock size.



Outdoor wintering on grass

The all grass wintering system has been developed to be capable of carrying 8-12 ewes/ha on lowland farms that exploits winter grown grass. The aim is not to feed supplements except when adverse weather intervenes (plan B) or to feed prudently just prior to housing. Grass is built up as a 'wedge' in late summer by getting lambs away off grass to give 2,000- 2,500kg DM which can be grazed down to 1,000kg in winter.

Ewes are mated either separately or on part of the winter grassland area where it is grazed down from 2,500 to 1,250kg DM/ha, with rams in for 21-24 days. Ewes then start the rotation which lasts 100-110 days. After this (10 days before lambing) ewes can be turned back onto the area grazed in the first 60-70 days or alternatively over the last 3 weeks concentrates are introduced building up to 0.5kg/day before ewes are housed. In southern and coastal areas there should be sufficient grass cover for outdoor lambing (1,500kg DM/ha).

The aim of this system is to give early grazed fields a long rest and all paddocks are grazed once. Later grazed paddocks will have shorter rest but the improved growing conditions should compensate for this. Within the system ewes are fenced into variable sized daily blocks depending on sward height / grass cover. Ewes should be allocated 1kg DM/hd/day from tugging to scanning - this gives maintenance ME supply of 9-10MJ/day.

Shifts can be of 1-3 days length, daily shifts are more accurate and use grass to best advantage but require more fencing and labour – shifts can be extended to 2-3 days on dense old pastures, any longer than this puts pressure on fences. In wet weather and on new seeds shorter shift periods are better (down to 12 hrs), this decreases the chance of grass being wasted and the ground being poached. After scanning ewes with multiples are allocated 1.5kg+ grass DM/day, singles can follow twins a day or two behind on very short swards to prevent lambs getting too big. It is essential to monitor body condition and remove ewes that are weak and/or thin. Existing health plans need to be modified due to risks of higher parasite challenge and trace element deficiency (bolus products become more effective with daily shifts). A contingency plan for supplementary feed should be in place for adverse conditions.

Calculating required grazing area:

If grass cover is at 2,000kg DM/ha (6-8cm sward height) and it is grazed down to 1,000kg DM/ha (3-4cm), then there would be 1,000kg of DM/ha of feed. A 65kg ewe would require 125kg of grass DM over a 100 day grazing period (calculated at 50 days of 1kg/ewe/day and 50 days at 1.5kg). Dividing 1,000kg DM/ha by a ewes requirement of 125kg/ewe gives 8 ewes to a hectare, therefore for a 1000 ewes there would be a need for 125ha for the 100 day grazing period.

Typical winter grass growth rate in coastal areas is around 10kg DM/ha/day giving a cover of around 1,500kg DM/ha by lambing. This uses around 65ha, which would be the first fields used in the rotation. These should be set stocked for lambing at 15 ewes/ha, with no supplementary feed. In upland areas expect growth would be 0-5kg DM/ha/day allowing up to half the flock to lamb outside in an favourable winter.

Working out daily paddock size

↓ Supply
A 4ha field has a rising plate meter estimated cover of 2,000kg DM/ha
Grazing to a residual of 1000kg DM/ha (grazed before scanning)
Available feed = (cover- residual) x area (ha) = (2000-1000) x 4 = 4000kg DM
↓ Demand
1000 ewes @ 65kg ewes in early pregnancy require 1.5% of bodyweight/day: 0.015 x 65 = 1.0kg/head/day = 1000kg for the flock per day

How many daily shift paddocks?

Available feed supply ÷ daily demand = 4000 ÷ 1000 = 4 days.

This shows that for a 1,000 ewe flock there is feed available for 4 days on 4ha, within a rotational grazing system these 4ha should be split into 1ha blocks and ewes moved daily.

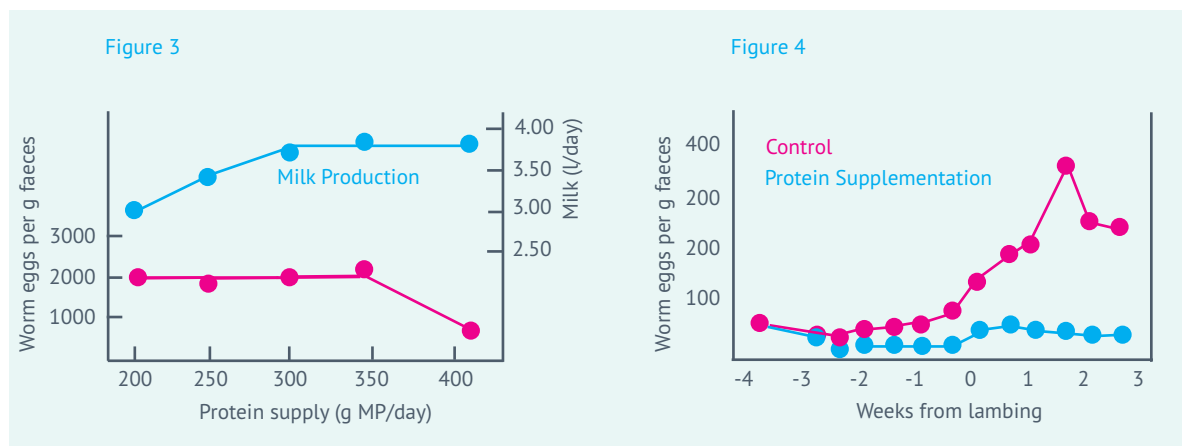
Parasite issues at lambing time

Parasites have a significant effect on performance

Ewes with a high worm burden produce less milk and are a major source of infection for their lambs. One ewe at 300 eggs per gram can produce enough infective larvae to reduce weight gain in 10 lambs or more.

High DUP in late pregnancy and lactation can reduce worm numbers and eggs deposited onto pasture, reducing dependency on wormers and the development of anthelmintic resistance. SAC trials show that to achieve this, protein levels must be approximately 20% higher than AFRC currently recommends – but the increased colostrum and milk production are a bonus and reduce labour costs.

For twin-rearing Mules, this means approximately 170 g metabolizable protein (MP) per head per day during late pregnancy, increasing to approximately 370g MP per day during early lactation. The study showed around 10% heavier lambs at birth, 30% increased milk production and a more than 60% reduction in worm burden (Figure 3) with almost 90% reduction in worm egg output (Figure 4). As a result, lambs had a temporary lower worm egg output, higher growth rate and higher weaning weight. These all contribute to getting lambs away from the farm earlier in the season. Savings can also be made on drenching, reducing the development of anthelmintic resistance.



Targeting protein

Not all ewes however are equally infective to the pasture. The protein available to ewes is prioritised to body maintenance, reproduction and finally mounting the immune response. Multiple bearing ewes in late pregnancy have to break down body protein reserves to supply glucose to keep their lambs alive. Hence, ewes rearing twins excrete 70-80% more worm eggs than ewes rearing singles, especially if they are in a poor condition. It may be worth grazing single rearing ewes separately and targeting twin-rearing ewes with extra protein during late pregnancy.

Other approaches

Grazing ewes and lambs on forages such as chicory can also improve lamb growth and reduce worm burdens by 40%. In early growing areas turning ewes and lambs onto second year chicory reduces dependence on concentrates for finishing and helps control the effects of worms.

Advice for outdoor lambing

Low labour availability is driving farmers to lambing outdoors, but low losses are a priority and 150-160% lambs sold/ewe mated is a realistic target. One person to 600-1000 ewes at lambing can reduce fixed costs.

Using temporary housing

Ewes can be housed from 12 to 2 weeks pre-lambing to rest lambing fields. The stocking rate when housed can be 50% higher by winter shearing ewes and cutting out lambing pens. An option could be to turn out 2 weeks prior to lambing.

Grazing

Newly grazed grass not only meets protein and energy needs but sets up ewes to lamb unaided.

- Clear fields 2-3 months pre-lambing to achieve target 6cm sward height at turnout;
- Ewes should be lean at turnout – CS 2.0-2.5 otherwise later born singles can be too heavy for an unassisted birth;
- Turnout 10-14 days pre-lambing to give ewes time to settle and choose a lambing site;
- Stop daily supplementary feeds – these disturb grazing and lambing behaviour;
- Stock lowland twins at 17/ha (range 7- 27), singles at up to 40/ha, halve this on upland units;
- Mob size maximum of 120 ewes, unsorted on lambing date;
- Lamb over 28 days - take rams out to ensure this;
- Consider grazing single rearing ewes separately, and targeting twin-rearing ewes with extra protein to help reduce worm burdens. Protein can be fed as 200g soya per head per day during late pregnancy, increasing to 400g soya per day during early lactation. Similar effects can be expected from 125g and 250g/d of protected soya.

Lambing Management

Avoiding having to handle outdoor ewes is key although an emergency overnight shelter is valuable.

- Start with lean ewes and a lambing date matched to pasture growth;
- Ewes with plenty of colostrum and used to human contact help;
- Use high maternal EBV ewes and rams;
- Select rams for easy births and the ability to suck unaided;
- Supplement with trace elements/vitamins to maximise lamb vigour;
- Cull problem ewes early – big teats, persistent footrot etc;
- Have a comprehensive health plan that is a working document;
- Expect some cross fostering – only some are able to rear triplets;
- Consider supplemental feeds such as buckets or blocks designed for outdoor lambing to help improve colostrum supply and lamb survival. These can be targeted at triplets, underweight twin bearing ewes and gimmers;
- Avoid having to tube lambs with supplemental colostrum – it is expensive and time consuming.



Feeding your ewes for lifetime performance

Year round attention to detail is needed

Trace elements from very early in life can have big effects, so relying on pre-lambing supplementation alone is not the answer. Avoid the impact of over or under-nutrition by feeding according to the needs of the ewe at the different stages of pregnancy.

Not all sheep are the same

Prolific breeds and first time lambers need different management.

New rules – new practices

If holding condition do not under supply cobalt as this can affect lamb viability through effects on the developing embryo.

An 18% CP ewe concentrate is an inadequate description

Dig deeper than looking just at the crude protein content of concentrates for pregnant sheep to avoid getting basic feeding wrong by underfeeding rumen undegradable protein in late pregnancy.

Getting it right saves lives

Extra rumen undegradable protein not only improves milk supply and lamb birth weight but also has long term effects on immunity and bonding between the ewe and lamb. Feeding extra to multiple bearing ewes also reduces the worm challenge to their lambs.

