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Strategic silage production for sheep systems

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Summary

- **The production of high quality silage for late pregnancy feeding provides the opportunity to meet more of the ewes' nutritional requirements from forage, reducing supplementary concentrate feed requirements and cost.**
- **Rationing has highlighted that the production of very high quality silage (11.5 ME), over moderate quality (10.5 ME), can save 12.5-13kg of concentrate feed per ewe depending on number of lambs carried saving £3.13-3.25 per ewe with concentrates budgeted at £250/t.**
- **Modelled for a 1000 head ewe flock scanning 200%, a 12.7t saving in concentrates worth £3,100 can be realised through feeding very high-quality silage over that of moderate quality silage or 27.2t of concentrates worth £6700 compared to feeding low quality silage or hay.**
- **There are several considerations to producing more high quality silage compared to moderate quality silage: including cost, practicalities and ewe condition. Modelling has found producing 50-55% of total silage as very high quality is optimal for mid-season lambing flocks scanning between 160-200%.**
- **Grouping ewes into early (1st 10 days) and late lambers, facilitates delayed concentrate feeding to late lambing ewes. Modelling of a 1000 head ewe flock scanning 200% found a saving of 3.16t of concentrates worth £790 to be possible through grouping ewes.**

Silage in sheep systems

The aim of any winter-feeding system is to fill the winter feed deficit and be as low cost as possible, whilst meeting the nutritional requirements of the pregnant ewe to optimise performance and profitability.

Compared to conventional silage/hay and concentrate feed systems, the production of high quality silage from leafy, high digestibility grass provides the opportunity to meet more of the pregnant ewe's nutritional demands from forage meaning less concentrate feed supplementation is required overall.

There are practical considerations to producing lower yielding, higher quality silage with an increase in the cost of production. However, this is offset by the reduction in purchased concentrates in late pregnancy. High quality silage is not required in early pregnancy and its value depends on litter size. As such, the aim is to produce sufficient quantities at appropriate qualities for different stages in gestation and to meet different litter sizes demand to minimise winter and late pregnancy feed costs.

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Silage quality, yield and cutting date

Silage quality is highly dependent on pasture composition and the nutritional value of the component grass, clover and herb plants. In a season, the stage of growth and reproduction grass is cut at for silage gives the greatest control over resulting silage quality as digestibility (D-value) and energy (ME) declines with increasing stem and ear emergence.

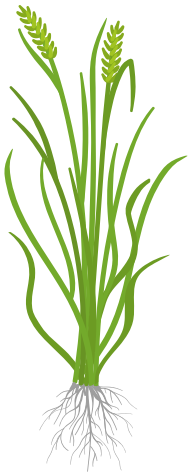
As a rule of thumb: D-value reduces by 0.5 units per day from when flowering stems emerge. With a 1% decrease in D-value resulting in a reduction in energy value of approximately 0.16 MJ/kg dry matter (DM) of ME.

Table 1 below outlines typical silage quality and yields when cut at different growth stages. Cutting when the grass is in a leafy state, prior to stem and ear emergence, facilitates the production of high-quality silage but at the expense of yield as the crop has not begun to bulk up with stem and heading.

Additional considerations impacting quality:

- **The balance of heading date between varieties in the sward – narrowing the range of heading dates optimises cutting date for quality.**
- **The cutting and ensiling process – consider weather and ground conditions, wilting time, equipment, cutting height, effective fermentation and additives.**

Table 1. Impact of growth stage at cutting on silage quality and yield

				
Silage quality	**Very high**	**High**	**Moderate**	**Low**
Growth stage	Leafy	Lengthening of stem	Flower heads emerging	Most of crop headed
Yield (tDM/ha)*	4.6	5.5	6.2	7.4
Ear emergence (%)	0-10	10-25	25-50	100
D-value (%)	69+	69-66	66-63	<63
Energy ME (MJ/kg DM	11+	11-10.7	10.7-10	<10
Crude protein ‘CP’ (%)	11-16	11-16	10-14	<11

Value of high-quality silage to reduce concentrate feed requirements

The impact of improving silage digestibility and quality on reducing concentrate supplementation requirements is two-fold. Firstly, the ewe can gain more energy and protein per mouthful of silage eaten (per kg/DM). Secondly, higher digestibility feed is more easily broken down in the rumen allowing increased intakes (Table 2).
Additional considerations impacting intake potential:

- **Chop length – precision chopped silage improves intakes of silage for sheep**
- **Compact bales that are hard to pull silage from, insufficient feed access, poor water supply and stale silage can all hinder intakes.**

Table 2 outlines rations for a 75kg ewe, based on litter size and different silage qualities – very high (11.5 ME), moderate (10.5 ME) or low (9.5 ME). Low quality silage (or hay) alone cannot meet the nutritional requirements of any in lamb ewes post-scanning and it should be noted that prior to 8 weeks pre-lambing that ewes would require supplementation or would lose at least 80g/day in weight and likely be short of protein.

Moderate quality silage however can meet the requirements of all classes up to 8 weeks pre-lambing, twins to 6 weeks and singles to 4 weeks pre-lambing. Very high quality silage has the potential to meet single requirements to 2 weeks, twins to 4 weeks and triples to 6 weeks pre-lambing and with significantly reduced daily requirements for concentrates.

Table 2. Daily concentrate feed requirements per ewe on differing silage quality

Kg concentrate/ ewe/day*	**Weeks from lambing**											
	8			6			4			2		
Silage ME	9.5	10.5	11.5	9.5	10.5	11.5	9.5	10.5	11.5	9.5	10.5	11.5
Singles	0.2	0	0	0.3	0	0	0.5	0.3	0	0.6	0.45	0.1
Twins	0.3	0	0	0.4	0.2	0	0.7	0.5	0.2	0.9	0.65	0.4
Triplets	0.3	0.1	0	0.5	0.3	0.1	0.8	0.6	0.35	1.0	0.8	0.6
Silage intakes kgDM/ ewe/day	1.05	1.2	1.35	1.05	1.2	1.35	0.9	1.2	1.28	0.9	1.2	1.28

**Assumes adequate silage CP above 11%. Good quality concentrate (12.5 MJ ME/kg DM). No weight gain or loss. Note that 55% of 1st cut and 28% of 2nd cut sheep and beef silages analysed by SAC were under 11% CP. Based on a 75kg ewe.*

Table 3 quantifies the rations shown in Table 2 on a total concentrate feed per ewe basis for the 8 weeks pre-lambing with 2-week pre-lamb feeding extended by 10 days to the mid-point of lambing. Higher quality silages dramatically reduce requirements for concentrate feeding. Taking twin bearing ewes as an example feeding very high quality silage in late pregnancy enables a 50% reduction in concentrate feed requirements saving £3.25/ewe compared to feeding moderate quality silage. For singles, concentrate feeding can all but be eliminated if forage quality is good enough. Consider both cost and labour savings.

There is opportunity to further reduce concentrate supplementation on high quality silages using appropriate protein sources. Seek expert advice as there are many factors involved.

Table 3. Total pre-lambing concentrate feed requirements and cost per ewe on differing silage qualities

	Concentrate per ewe (kg)			Cost per ewe (£)*		
Silage ME	9.5	10.5	11.5	9.5	10.5	11.5
Singles	28.4	15	2.4	7.1	3.75	0.6
Twins	41.2	25.4	12.4	10.3	6.35	3.1
Triplets	46.4	33.2	20.7	11.6	8.3	5.18

**Concentrates at £250/t.*

Table 4 outlines total concentrate feed requirements for a 1000 head ewe flock scanning 200% based on the rations and assumptions outlined in Tables 2 and 3. It highlights that to produce low quality silage or hay would mean 39.2t of concentrate feeding is required for late pregnancy feeding at a cost of £9,803 or £9.80 per ewe. Feeding moderate quality silage, total concentrate requirements are reduced to 24.7t costing £6,186 or £6.19 per ewe. Whilst producing very high-quality silage for late pregnancy feeding can halve requirements compared to that of moderate quality with just 12t required for the 1000 ewe flock at a cost of £3,072 or £3.07 per ewe.

Table 4. Total concentrate feed requirements for a 1000 head ewe flock scanning 200% fed differing silage qualities

	Ewe numbers (hd)	Total (t)			Total cost (£)		
Silage ME		9.5	10.5	11.5	9.5	10.5	11.5
Singles	140	4.0	2.1	0.3	994	525	84
Twins	630	26.0	16.0	7.8	6,489	4,001	1,953
Triplets	200	9.3	6.6	4.1	2,320	1,660	1,035
Total	**970***	**39.2**	**24.7**	**12.0**	**9,803**	**6,186**	**3,072**

**3% barren rate. Concentrates at £250/t.*

Cost of producing high-quality silage

Table 5 shows an example of the additional cost of producing higher quality silage where bales are produced from lower yields – £0.50 per bale or 0.3p/kgDM more to produce very high quality over moderate silage which can be cut later to gain additional yield. Consider that concentrate feed cost is around 25pkg/DM.

There are concerns in some systems that to make high quality silage would compromise total yield per hectare requiring additional ground and cost. However, high quality is not required throughout pregnancy so on a two or more cut system there is still the option to do a higher yield second cut targeting moderate quality for early-mid pregnancy feeding and therefore total silage yield needn't be compromised.

Table 5. Cost of harvesting silage bales at different yield/ha

Silage quality	Low	Moderate	Very high
Yield (tDM/ha)	7.4	6.2	4.6
Bales per ha (650kg 30%DM)	38	32	24
Mowing, tedding and racking cost (£/ha)	46	46	46
Baling and wrapping (£/ha) £7/bale	266	223	165
Cost - total per ha (£)	**350**	**300**	**235**
Cost - per bales (£)	**9.21**	**9.45**	**9.95**
Cost - p per kgDM	**4.7**	**4.8**	**5.1**

Feed budgeting

Rationing shows how poor-quality silage (9.5ME), or hay production, is less cost-effective than better quality silage during ewe pregnancy. Feeding conserved forage under 9.5ME to 75kg ewes without additional feed will result in condition loss. If poor silage or hay is produced, then consider feeding to ewes in early winter rather than late pregnancy so to reduce supplementation requirement. Feed to over fat ewes >4BCS only, without supplement, accepting weight loss but only to 8 weeks pre-lambing. Alternatively, feed this lower energy forage to cattle.
The aim for crossbred/lowland ewe flocks should be to produce all sheep silage required to moderate quality (10.5 ME) or better, cutting before ear emergence exceeds 50% and when the crop is still leafy.

Production of very high quality silage (11.5 ME) provides the opportunity to dramatically reduce concentrate feed requirements and cost from 4-8 weeks pre-lambing. However, prior to 8 weeks pre-lambing, this quality silage will exceed their requirements if fed ad lib and therefore they may gain condition even if no additional feed is provided. This could be particularly problematic for single bearing- and fat- ewes in terms of metabolic issues and dystocia. Table 7 below outlines the feeding period pre-lambing that it is optimal to feed very high quality silage based on number of lambs carried. Excess high quality silage produced can be best utilised by feeding it to thin ewes <3 BCS prior to the period shown for their number of lambs carried to gain condition and optimise lamb performance.

Table 7. Optimal silage - **moderate (10.5 ME)** or **very high quality (11.5 ME)** - to reduce concentrates whilst balancing practical forage production

	Winter feeding	Weeks' pre-lambing			
	Up to 8 weeks pre-lambing	8	6	4	2
Singles					
Twins					
Triplets					

**Based on rations and assumptions in table 2. Very high quality silage (11.5 ME) is shown in green and moderate quality (10.5 ME) in orange.*

Table 8 outlines silage requirements for a 1000 head ewe flock scanning at 200% as shown in Table 4, fed the silage qualities at different time points shown in Table 7 with 2-week pre-lamb feeding extended for 10 days to account for mid-point of lambing at quantities shown in Table 2. Ewes are fed silage from 1st January with lambing commencing 1st April. It shows that to maximise the reduction in concentrate feed, making 55% of total silage as very high quality is optimal. This requires 22.2ha cut at 4.6tDM/ha for very high quality silage with 13.7ha of silage targeted as moderate quality. In practical terms this may be 13.7ha of 1st cut as very high quality followed by a second cut targeting higher yield moderate silage. The remaining 8.5ha of very high quality taken as 4.25ha cut twice or a proportion of this made up from strategic silage cut from surplus in rotational grazing systems.

Table 8. Silage requirements for 1000 flock scanning 200%

Silage quality	Total requirements* t/DM	Proportion total (%)	Bales**	Ha required
Moderate	84.7	45	434	13.7 (6.2tDM/ha)
Very high	102.3	55	524	22.2 (4.6tDM/ha)

**Assumes 70% utilisation **650kg bales 30%DM*

When modelled for a flock scanning at 180% the proportion of bales required as very high quality was reduced to 52%. Whilst for a flock at 160% scanning this came down to 50%. The impact depends on the proportion of single and multiple bearing ewes and barren rate.

Value of grouping on lambing date

Lambing is a prolonged affair, as is feeding of concentrates at peak pregnancy level, with a mid-point at ~10 days. Provided flock size and management groups are sufficient, grouping ewes into early (1st 10 days) and late (2nd 10 days onwards) lambers from scanning onwards provides the opportunity to hold off commencing concentrate feeding and higher quality silage for an additional 10 days to later lambing ewes.

Early and late lambers can be identified by either tup raddling or scanner judgement. Table 9 below shows potential cost savings for a 1000 ewe flock with 500 ewes separated into lates to be 3.16t of concentrates worth £791. The greatest value to splitting due to mob size is with twins worth £512. Table 7 below outlines the feeding period pre-lambing that it is optimal to feed very high quality silage based on number of lambs carried. Excess high quality silage produced can be best utilised by feeding it to thin ewes <3 BCS prior to the period shown for their number of lambs carried to gain condition and optimise lamb performance.

Table 9. Concentrate savings for a 1000 head ewe flock scanning 200% fed moderate quality silage over 10 days achieved by grouping early and late lambers

	Ewes		Concentrate saving		
Type	% flock*	Ewes (no.)	Per head (kg)	Total (t)	Total value £**
Singles	14	70	4.5	0.32	79
Twins	63	315	6.5	2.05	512
Triplets	20	100	8	0.8	200
Total		**500**		**3.16**	**790**

**3% barren rate. **Concentrates at £250/t.*

The same scenario based on lates being 2nd cycle (post 17 days) with 22% of ewes in the category realised a saving of £348.

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