Technical Updates on Sheep Production

Compiled and Edited

by

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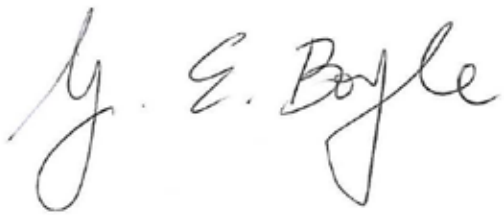
Foreword

Sheep production is a significant contributor to the agricultural and national economy with an output valued at €180 million in 2011. This is despite the national ewe flock declining from a peak of more than four million ewes to a current flock of 2.5 million ewes. The 32,200 flocks produce a high quality product, with 70% of this exported. Significant employment is provided in both the primary production and processing sectors. Buoyant prices for the past two years are now giving confidence to producers to expand. In the Teagasc National Farm Survey, the top one-third of flocks generate a gross margin of €766/ha and there is significant scope to increase this by improving technical efficiency at farm level. Major challenges are to improve ewe prolificacy, increase stocking rate, and to manage the challenge of increasing resistance to anthelmintics. Grass must be the basis of profitable sheep production. There is tremendous scope to grow more grass on farms, use it more efficiently, thus allowing increased stocking rates, better performance and lower costs. Nationally, the number of lambs reared per ewe joined is 1.3 and has remained at this level for years. This is low by UK standards (1.5) and there is therefore significant scope to improve output. The establishment of Sheep Ireland will accelerate the genetic improvement of the national sheep flock for both maternal and terminal traits. Teagasc is committed to sheep research and advice. The new Research Demonstration Flock at Athenry combined with an expanded BETTER Sheep Farm Programme will accelerate the transfer of technologies from research to the industry.

This book collates a significant body of knowledge on technical issues in sheep production. It is a summary of the state-of-the-art knowledge for sheep producers, advisors, veterinarians, students and others. It will inform those interested in developing sheep enterprises and improving technical efficiency and profitability and will be a useful reference for many years to come. I would like to commend all the authors involved and the support staff who assisted in the research over many years. Particular thanks to the editors, Michael G. Diskin and Michael P. McHugh.



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Improving the Efficiency and Profitability of Your Sheep Flock

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Despite the decline in both sheep numbers and sheep farmers since the 1990s, sheep production is still an important farm enterprise on many farms in this country. There are currently 32, 200 sheep farmers with a breeding ewe flock of 2.5 million ewes. Sheep farming is the second most popular farm enterprise after cattle production with an annual output value of €180 million in 2011. Ireland is 340% self sufficient in sheep meat resulting in over 71% of the total production been exported. The lowland sheep flock is the major source of lamb output, accounting for 85% of carcass output. The hill flock and mountain flocks account for the remainder.

The short to medium-term outlook for world sheep meat markets and lamb prices is positive with demand expected to exceed supply over the coming years. This is resulting in a renewed confidence in sheep and there is now an ideal opportunity to improve flock management to capture the potential that this new environment creates to improve returns from sheep farming.

Results from Teagasc eProfit Monitors and National Farm Survey (NFS) data clearly shows that well managed sheep production enterprises can return gross margins that compare very favourably with other drystock enterprises. These results also shows that the number of lambs reared per ewe joined, stocking rate and concentrate feeding to ewes and lambs are key drivers of profitability. There are a number of key components that individual sheep producers can adopt that will enhance the profitability and ultimately the sustainability of their enterprise

Focus on Factors that are Under Your Control

Specifically, sheep producers should focus on factors that are under their control and that significantly impact on output and profitability including:

Adopt a 3-5 year business plan for your sheep enterprise. Here the focus should be on drivers of profitability namely increasing:

- Stocking rate;
- The number of lambs reared per ewe joined, and ,
- Reducing the amounts of meals fed to ewes and lambs.

Prolificacy is a major driver of output in lowland flocks

Concentrate on Production from Grazed Grass

Grass is the cheapest form of feed and must be central to efficient profitable lamb production. The first objective must be to grow sufficient grass and second to maintain quality leafy grass in front of the ewes and lambs at all stages. There is also scope on many farms, particularly on dry farms, to extend the grazing season at both ends of the year thus reducing conserved feed requirements.

Develop a Plan to Provide Prolific Flock Replacements

Serious lowland sheep producers must develop a strategy of producing, either from within their own flock or from an outside source, prolific flock replacements. Numerous studies that show that the female progeny from Belclare rams have the capacity to wean 1.75 lambs per ewe joined.

Carefully Examine the Amount of Concentrates Fed to Lambs

There is significant evidence that on some farms, that an excessive amount of purchased concentrates are fed to both ewes and lambs. Much of this is unnecessary and is doing nothing for profitability except replacing cheaper grazed grass in the diet of the ewes and or lambs. Consider creep grazing lambs ahead of ewes as an alternative to creep feeding of concentrates to lambs. Lamb production

systems based on high usage of concentrates become less sustainable when concentrate prices are high and or lambs prices are low.

Grazed grass must be the basis for profitable lamb production. There is significant scope to improve grassland management on Irish sheep farms

Resistance to Anthelmintics

There is mounting evidence that resistance to anthelmintics is becoming a problem on many farms. Producers are advised to strategically use these drugs and to ensure the correct dosage is delivered. Faecal egg sampling of lambs should be used to determine the dosing strategy from weaning, combined with the provision of "clean pasture" to lambs after weaning. Where there are suspicions regarding the efficacy of a particular drug this should be investigated through pre and post dosing faecal egg counts and an alternative drug should be used.

Winter Shearing of Ewes

Research at Atherny has shown that shearing ewes at the start of housing in December will increase lamb birth weight by about 0.5kg, and increasing weaning weight by about 2kg resulting in advancing age at slaughter by two weeks. This is a significant and easily attainable productivity gain that could be financially very worthwhile particularly in an environment of declining lambs prices from June onwards.

Learn from Teagasc Better Sheep Farms

Teagasc has established a number of Lowland and Hill BETTER sheep farms to accelerate technology transfer from research to farm practice. Well-established breeding, grassland, nutrition and flock health technologies are being applied and evaluated on these farms. Discussion Groups, through the B&T adviser visit these farms on a regular basis. If not already a member of a Discussion Group, sheep producers are encouraged to join one, and learn and adopt technologies from these BETTER farms.

Further Integration of Hill and Lowland Sectors

In some of the mountain and hill areas Producer Groups have been established to produce prolific crossbred replacements for fat lamb production on the lowlands. There is scope for further expansion of such initiatives and the certification of the heath status of lambs from such groups would further enhance their value and attractiveness to lowland buyers.

There is scope to produce health-certified prolific replacements from hill flocks

Marketing and Lamb Quality

Lamb should be managed and marketed so as to maintain a high quality standard that merits a premium price in the market place. Carcase weight and fat cover are the most important factors in determining carcase quality. Producers need to be familiar with the carcase specifications for the market they supply and select lambs to fit those specifications. The Bord Bia Lamb Quality Assurance Scheme standard is now a widely recognised standard and membership of this scheme will enable lamb to be sold on the higher priced premium markets.

Genetic Improvement

Sheep Ireland is charged with developing a new breeding programme focussed on:

- Increasing the profitability and sustainability of the national sheep flock, by improving productivity and reducing the costs to the sector, with a clear focus on the requirements of the market place.
- Progressing significant infrastructural changes and enhancements to the national breeding system to ensure a viable and sustainable sheep breeding structure into the future.

In future, Sheep Ireland will provide genetic indices for both maternal and terminal traits of rams. Producers should aim to use high genetic merit sires in their flocks. Consistent use of high genetic merit sires will result in permanent cumulative increases in productivity in your flock.

Grassland Management for High Lamb Performance

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To improve the financial margin from mid-season prime-lamb production it is essential to optimise performance from grazed pasture. Whilst grazed grass is an expensive forage to produce, it is the cheapest feed available to the ewe flock. In well managed systems of mid-season prime-lamb production, grass is the only feed, except for the mother's milk, that lambs receive from birth to slaughter. To achieve high levels of lamb performance from grazed grass a continuous supply of high feed value pasture is required for the duration of the grazing season. Feed value is a combination of nutritive value (i.e. digestibility) and intake characteristics (combination of herbage supply and digestibility).The aim of this paper is to present information, based on research studies undertaken at Athenry, on maximising lamb performance from grazed pasture, and the management necessary to achieve this.

Lamb Performance from Grazed Grass

Lamb performance pre-weaning is influenced by rearing type i.e. number of lambs reared by a ewe (Table 1). Studies at Athenry have clearly shown that high daily live weight gains of lambs reared as singles or twins are achievable from grazed grass offered as the sole diet.

Table 1: Target lamb pre-weaning daily live weight gain from grazed pasture

Rearing type	Gain (g/day)
1	340
2	295
3	290

(Keady, 2010)

At Athenry, lambs reared as triplets are offered up to a maximum of 300g of concentrate daily until weaning whilst their dams receive 0.5kg daily for the first five weeks post-lambing. Using the data presented in Table 1, flocks weaning 1.3, 1.5, 1.7 and 1.9 lambs per ewe put to the ram, target flock lamb average daily live weight gains from birth to weaning are 322, 312, 303 and 293g/day, respectively.

Autumn Closing Date

One of the main factors influencing grass availability in early spring is the date of closing the previous autumn. The data presented in Table 2 clearly illustrate the effects of autumn closing date on subsequent herbage yield and that the effect is still clearly evident by 1 May.

Table 2: The effect of closing date on subsequent cumulative herbage dry matter yield (kg/ha)

	Closing date			
Grazing date	**5 Dec**	**19 Dec**	**2 Jan**	**23 Jan**
3 April	610	337	175	62
17 April	1810	1443	1156	846
1 May	3570	3323	3015	2462

(Keady and Hanrahan 2011)

Previous studies at Athenry have shown that for each one day delay in autumn closing date herbage dry matter yield in spring is reduced by 22 kg/ha. Consequently, delaying sward closure by one week in the autumn would reduce grass dry matter availability the following spring by 154 kg/ha, which is equivalent to 50 ewe grazing days. Therefore, to ensure grass availability for ewes at lambing, paddocks should be closed from early November onwards.

Pasture Management for High Lamb Performance

Effective grassland management involves matching grass supply and feed value with animal requirements. Grass growth varies throughout the grazing season. For example, typical daily grass dry matter growth rates for March, April, May, June, July, August, September and October are 10, 30, 70, 60, 50, 60, 40 and 30 kg/ha, respectively. Meanwhile, the demand of the ewe and lamb flock increases reaching a peak prior to weaning and declines thereafter as the requirements of dry ewes decline and lambs are being drafted for sale.

The main objective of grassland management is to have a plentiful supply of highly digestible grass available to the animals for the duration of the grazing season. However, as the grazing season progresses grass matures and goes from vegetative to reproductive state consequently increasing the proportion of stem and reducing digestibility and intake potential. Therefore, to achieve optimum levels of lamb performance from grazed grass, pasture must be managed to maximise the proportion of leaf in the sward canopy, thus maintaining herbage digestibility and intake potential. This is achieved

by grazing swards to predetermined residual heights during the grazing season. Sward height measurement is the easiest and most effective way of managing pasture. For ewes and their lambs target post-grazing sward heights, which differ for rotational and set stocked grazing systems, based on many studies undertaken at Athenry are summarised in Table 3.

Graze sward tight in early season to maintain grass feed value

Table 3: Recommended sward heights for target lamb performance (cm)

	Grazing system	
Month	**Rotational – post grazing**	**Set stocked**
March	3.5 – 4	5
April	3.5 – 4	5 – 6
May	4.5 – 5	6
June	5.5 – 6	6 – 7
July	6	7 – 8
August	6	7 – 8
September	6	8

(Keady 2010)

To obtain high levels of lamb performance from pasture it is essential to graze the swards tight (low post grazing sward height) in April and May. Tight grazing during this period reduces stem elongation and thus maintains a higher proportion of leaf in the sward canopy for the remainder of the grazing season. Increasing the proportion of leaf maintains herbage feed value due to higher digestibility which positively affects intake characteristics. Furthermore, lax grazing necessitates topping which reduces herbage utilisation subsequently increasing the costs of production.

Similar levels of lamb performance are achievable from well-managed set stocked and rotational-grazed systems. The main advantage of the rotational grazing system is that it simplifies the removal of excess herbage (paddocks) from the system during periods of rapid grass growth (e.g. early May), for forage conservation and enables the inclusion of extra herbage (e.g., aftergrass) when grass growth slows down in mid-summer. Also the rotational grazing system facilitates higher grass utilisation consequently reducing costs of production.

Grazing Management at Athenry

Pastures at Athenry are closed in rotation in the autumn, the first paddocks are normally closed in early November and all sheep are housed by mid December. The effects of autumn closing date on sward heights on 29 January and 20 March are presented in Figure 1.

Earlier closing results in higher sward heights at each time of measurement. Furthermore, swards closed in early November had the same sward height on 29 January as swards closed on 28 November had on 20 March. All grazing ground receives N at 33kg/ha in mid-February.

The flock at Athenry, which is used for grassland and nutrition research consists of 350 crossbred ewes and is stocked at 14 ewes/ha. Each year, for experimental reasons, approximately 100 ewe hoggets are included in the flock. Prior to lambing (depending on experimental treatment) ewes receive an average of 20kg concentrate in late pregnancy. Lambing commences on 1 March and the majority of ewes are lambed by 20 March. Post-lambing ewes rearing singles and twins, and their lambs receive no concentrate supplementation whilst at pasture. Ewes rearing triplets receive 0.5 kg concentrate per ewe daily for five weeks post-lambing whilst lambs reared as triplets receive up to 300g concentrate daily until weaning. Post weaning all lambs are grazed as one flock and receive no concentrate supplementation.

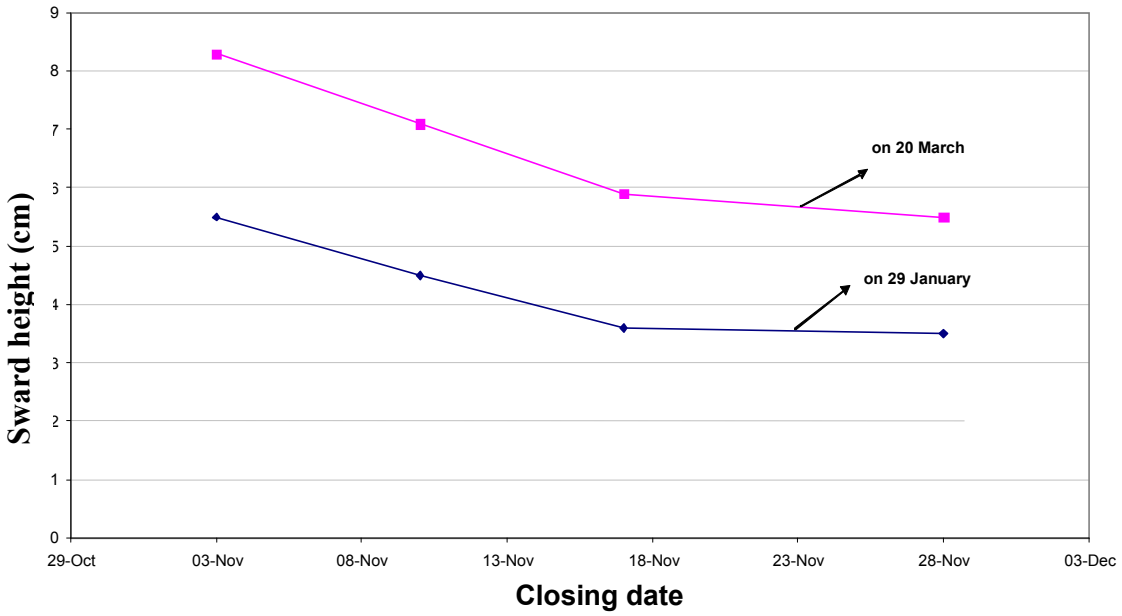

Figure 1. Effect of autumn closing date on sward height in early spring

Drafting for Athenry flock

The drafting information for all the lambs (regardless of experimental treatment) from the Athenry flock for 2008, 2009 and 2010 are presented in Figure 2. During 2008, 2009 and 2010 the number of lambs reared per ewe were 1.7, 1.7, and 1.7, respectively. Average carcass weight increased from 19.0 to 20.6kg between 2008 and 2010.

Data presented in Figure 2 clearly shows that, during three consecutive years, which differed dramatically in weather patterns and consequently grass production, all lambs from a prolific flock can be consistently finished from grazed grass offered as the sole diet.

At Athenry, from 1 April to 30 June, total rainfall was 225 mm, 350 mm and 156 mm in 2008, 2009 and 2010 respectively. In 2008, grass supply was scarce due to low temperatures in mid-April, with the post grazing sward height being as low as 2.6 cm at times. However, no concentrate was offered to either the ewes or their lambs. For April, May and June 2008 mean post-grazing sward heights were 3.5, 4.8 and 5.5 cm and mean pre-grazing sward height were 6.4, 8.6 and 7.9 cm respectively. Managing the sward as described above resulted in mean daily live weight gains from birth to weaning of 336, 292 and 296g daily for singles, twins and triplets respectively.

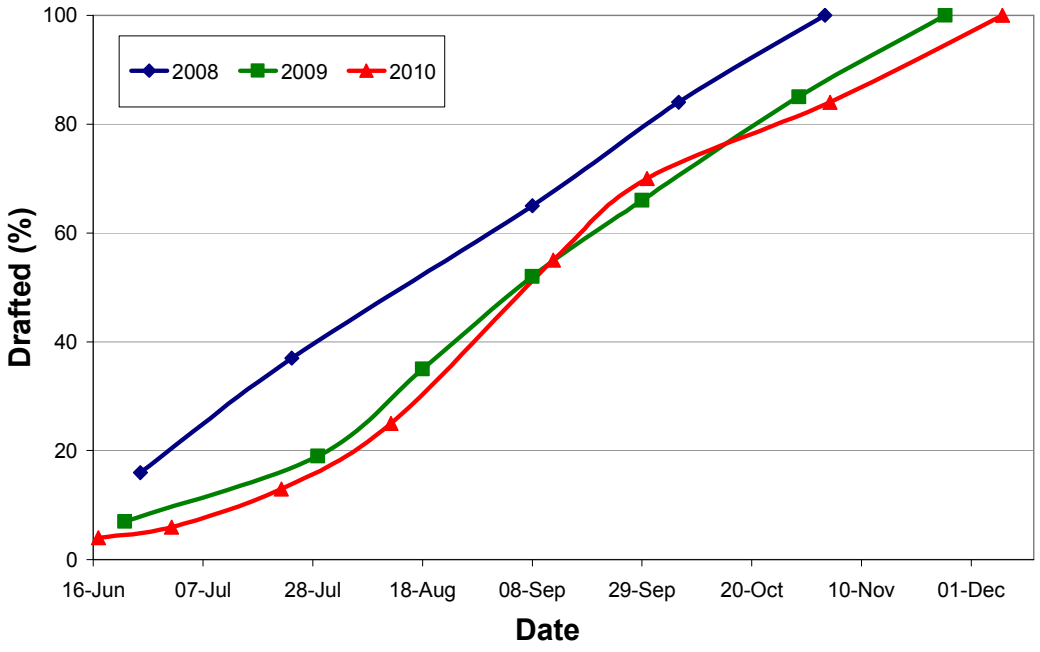

Figure 2. Drafting pattern for the Athenry flock for the past three years

April and May in 2009 were characterised as extremely wet with total monthly rainfall of 150 mm and 131 mm, respectively. For April, May and June mean post-grazing sward heights were 3.8, 3.8 and 4.0 cm and pre-grazing sward height were 5.8, 7.0 and 6.6cm respectively. Pre-weaning lamb daily live weight gains were 338, 279 and 284g for singles, twins and triplets, respectively.

In 2010 March, April and May was characterised as a period of low temperatures consequently grass supply was scarce. Ewes were supplemented with concentrate for three weeks post-lambing. Furthermore June was extremely dry with only 13mm of rainfall recorded during the first 26 days of June 2010. Consequently, in June due to drought conditions grass supply was scarce and it's feed value was low due to seed head elongation. For April, May and June mean post-grazing sward heights were 3.0, 4.6 and 4.9 and pre-grazing sward heights were 4.4, 7.2 and 7.7 cm, respectively. Pre-weaning lamb daily live weight gains were 310, 265 and 257g for singles, twins and triplets, respectively.

The data presented for 2008 show that even when there was grass shortage in April and May, due to low temperatures, and for 2009 which was extremely wet and in 2010 due to cold temperatures in March and April and drought in June that high levels of lamb performance

can be achieved consistently when grazed grass is the sole diet offered to ewes and their lambs.

The data presented in this paper, based on many years of research at Athenry clearly illustrate that high levels of lamb performance are achievable form grazed grass offered as the sole diet. The key to achieving high levels of lamb performance from pasture is the provision of adequate quantities of high digestibility herbage. The easiest way to manage grassland for the flock is to use sward height when deciding on flock management to new pasture, and the removal of paddocks for forage conservation.

Target live weight gain for twin lambs pre-weaning is 295 g/day from grazed grass

Producer 1 – A Case Study

Producer 1 produces heavy lamb carcasses from grass without any concentrate supplementation offered to ewes rearing singles or twins or their lambs post lambing. Ewes rearing triplets receive 0.5 kg concentrate daily for five weeks post-lambing whilst lambs reared as triplets are offered up to 300g supplement until weaning. The mean lambing date varied from 15 to 20 March for the years 2008, 2009 and 2010. Weaning rate for this flock, for the years 2008-2010, varied form 1.7 to 1.8 lambs weaned per ewe to the ram.

Post-weaning all lambs are grazed in one flock without any concentrate supplementation. The mean carcass weight for the lambs in 2008, 2009 and 2010 was 21.8, 21.1 and 21.7 kg respectively. The drafting patterns for the flock , for the last three years, are presented in Figure 3.

The data in Figure 3 clearly illustrate that heavy carcasses can be consistently produced from mid-season prime lamb systems where grass is offered as the sole diet to lambs reared as single and twins pre-weaning and to all lambs post weaning. Furthermore, due to the adoption of good grassland

management i.e. grazing to the recommended post grazing sward heights, particularly tight grazing in April and May, the drafting pattern improved between 2008 and 2010.

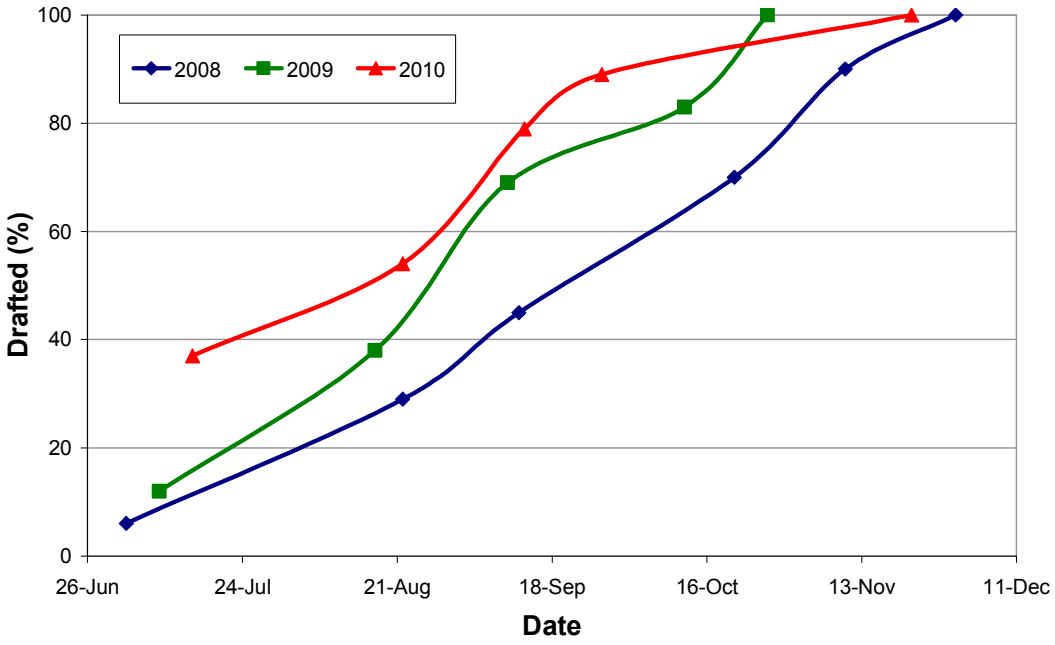

Figure 3. Drafting pattern for the commercial flock for the past three years

Summary

1) Heavy lamb carcasses can be produced form grazed grass offered as the sole diet.
2) To achieve high lamb performances match grass supply and feed value with animal requirements.
3) Graze pastures to pre-determined sward heights.
4) Grass swards tight, post-grazing sward heights of 3.5 to 4 cm, during April.
5) Increase post grazing sward height as the season progresses.

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Reseeding Options to Improve Pasture Productivity

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Many farms in Ireland have swards that cannot grow enough grass during the year especially in spring and autumn. This is mainly due to the absence of productive perennial ryegrasses in the swards. There are many beneficial reasons for reseeding as perennial ryegrass dominant pastures:

- Provide more grass in the shoulder periods of early spring and late autumn
- Are 25% more responsive to nitrogen compared to old permanent pasture
- Have faster re-growth
- Support higher stocking rates

Increased Productivity

As well as having more grass in early spring and late autumn newly reseeded swards are more responsive to nitrogen. This means that compared to old permanent pastures reseeded swards yield more grass per kg of nitrogen applied. Figure 1 shows the spring and autumn DM production of two pastures, an old permanent pasture and a new reseed. It is clear that the reseeded pasture with its high perennial ryegrass content produces more grass in spring and autumn compared to the old permanent pasture (30% perennial ryegrass) which will not support early or late grazing systems as insufficient grass is being produced.

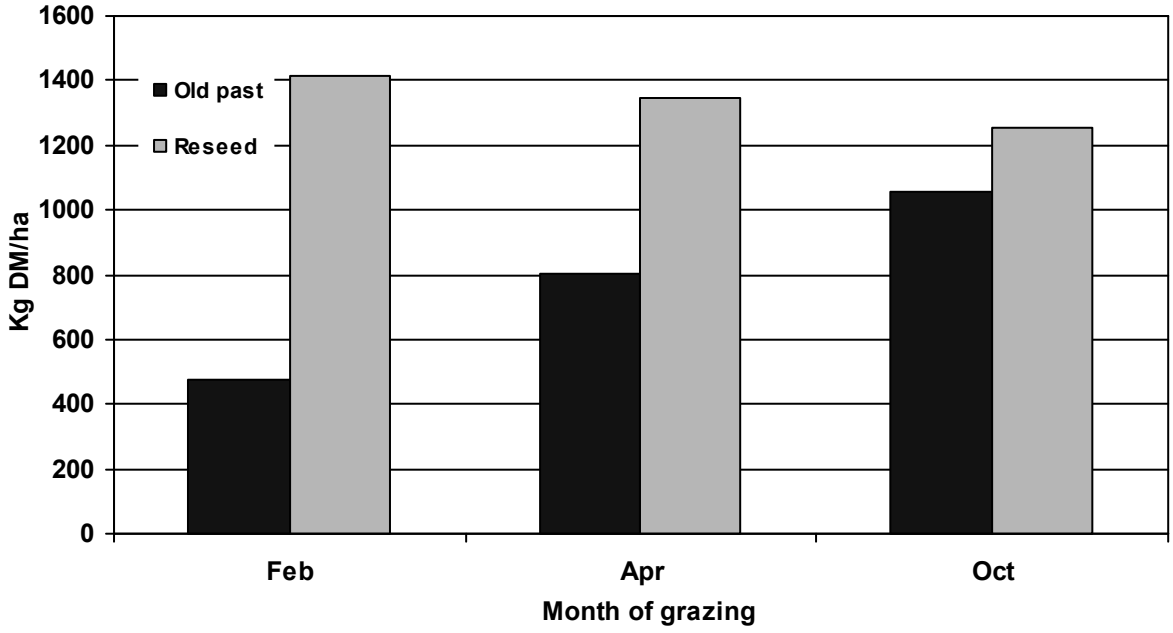

Figure 1. Effect of pasture perennial ryegrass content on DM yield

Reseeding should be considered when the amount of open ground and broadleaved weeds present becomes excessive

Methods of Reseeding

There are essentially two methods of preparing the seed bed. The most common method is ploughing. However, on many farms this is not possible because the ground is too stony, soil is too shallow and topography too steep or there is no tradition of ploughing. Minimal cultivation techniques enable successful reseeding to be carried out without ploughing. Regardless of reseeding method, the old sward should be burned off using Glyphosate (Roundup) 10-14 days prior to cultivation to allow enough time for the active ingredient of the spray to be carried throughout the plant to ensure adequate kill. After sowing, the seed bed should be rolled to "press-in" the seeds and ensure good seed-soil contact. Loose seed beds allow moisture to evaporate and cause drying out of seeds thus inhibiting germination.

A firm, level seed bed is required for small grass and clover seeds

Conventional Reseeding

Ploughing, although the most expensive option, is probably the most reliable method. The advantages of ploughing are that pests, thrash and native competitor grasses are buried.

Ploughing can also help the drainage of the soil profile. In addition, it provides the basis for a sound seed bed and more level surface. Care must be taken, however, not to plough too deeply (>15 cm) as this can bury the top layer of the most fertile soil. After ploughing the objective is to develop a fine, firm and level seed bed. If the tilt is not fine enough, grass seed (especially clover seed) will be lost too deep into the soil and will not be able to germinate.

Minimal Cultivation

Minimal cultivation techniques allow perennial ryegrass to be introduced into swards without ploughing, using shallow cultivation equipment. Soil disturbance is minimised so the more fertile soil remains at ground level for use by the young seedlings as well as better support for both machinery and animals at the early stages of pasture establishment. This is a fast and simplistic method of reseeding. It is important that the sward is grazed tightly if minimum cultivation techniques are to be used as surface trash will not be buried. Some surface trash will remain and as this thrash (dead organic matter) decays it releases organic acids which may inhibit seed germination. Applying about 2tonnes of lime/acre before cultivation will help neutralise this effect. With minimum cultivation more weeds may appear making the use of a post emergence spray even more critical.

Results from Teagasc Studies

A study at the Animal & Grassland Research and Innovation Centre, Moorepark, compared a number of reseeding methods as follows:

i) Plough + level + one pass cultivation (PLO);
ii) One pass cultivation (OP);
iii) Direct drill (DD); and ,
iv) Discing + one pass cultivation (DOP).

These methods were compared to a control (C), old permanent pasture which was not reseeded. All swards (excluding the control) were sprayed with Glyphosate (Roundup) ten days prior to reseeding on 7 May and the initial grazing took place on 2 July. Dry Matter yield was measured across the year pre spraying off and after cultivation to document the cumulative DM production for the year.

Table 1: Effect of reseeding method on DM yield in year of establishment

Treatment	C	PLO	OP	DD	DOP
DM yield (t DM ha)	9.8	9.5	10.9	10.7	9.8

The results in Table 1 clearly show that although the reseeded areas were out of production for over two months their annual dry matter production was similar, if not greater than, the control area which

was accessible for the entire year. The DM production of the swards with the imposed treatments was also quantified in their second year. The ploughing treatment produced 27% more grass DM than the control, followed by one-pass (+26 %), Direct drill (+20%) and Disc (+13 %). Little difference was found between reseeding methods. Choice of cultivation method comes down to soil type, degree of stoniness and proximity to machines. The majority of the difference in DM yield between the reseeded swards and the old permanent pasture was accounted for in the spring, a critical period for grass supply.

Reseeded pastures will not perform to their potential if soil fertility is not corrected. New seedlings are particularly susceptible to a lack of lime and phosphorus.

Timing of Reseeding

Most reseeding takes place in the autumn on sheep farms. This makes sense from a feed budget point of view but it does have some negative consequences. Conditions deteriorate as autumn progresses – lower soil temperatures can decrease seed germination and variable weather conditions reduce the chances of grazing the new sward. Table 2 outlines the effect of autumn sowing date on seedling and tiller population and grass availability (kg DM/ha) in spring. If clover is to be included as part of the seed mix it should be noted that the threshold soil temperature required for clover growth is much higher (8^{o}C) than for grass (6^{o}C). With this in mind if planning to reseed, it should be completed as early as possible (July/early August).

Table 2: Effect of sowing date

Sowing Date	3 September	4 October
Seeds sown/sq. m	1030	1030
Seedlings 6 weeks later/sq. m.	760	570
Tillers/sq. m. in March	7190	3110
Kg DM/ha in March	913	478

(Culleton et al., 1992)

Soil Fertility

Poor soil fertility is one of the main reasons for the disappearance of ryegrass from pastures. Reseeded pastures will not perform to their potential if soil fertility is not corrected. New seedlings are particularly susceptible to a lack of lime and phosphorus. The exact quantities of lime and fertilisers required can be determined from a soil test which should be carried out once the soil has been cultivated as it is this layer of soil that the seedlings will be established in.

Weed Control

The best time to control weeds is after reseeding. By using a post emergence spray seedling weeds can be destroyed before they develop and establish root stocks. Established weeds can seriously reduce the yield potential and economic lifetime of the reseeded sward. The post emergence spray should be applied approximately six weeks after establishment just before the first grazing takes place. Again, the later reseeding takes place, the opportunity to apply a post-emergence spray is reduced as ground conditions are often unsuitable for machinery to travel on.

Summary

Reseeded pastures provide more grass in the shoulder periods (early spring and late autumn), are up to 25% more responsive to nitrogen compared to old permanent pasture, and are capable of supporting higher stocking rates. Reseeding should be undertaken as early in the autumn as possible using a method of seed bed preparation best suited to your farm. Prepare a fine, firm seed bed applying fertiliser and lime according to soil test results and apply a post emergence spray 6-8 weeks after sowing for weed control.

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Reseeding Pasture: Should You Consider Chicory or Tyfon?

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Weaned lambs can achieve high daily live weight gain from grazed grass offered as the sole diet. Nevertheless, producers are often unable to finish lambs without concentrate supplementation. Previous studies at Athenry have clearly demonstrated, that whilst concentrate supplementation at pasture increases lamb performance, it is not economically justified for lambs that are marketed after the end of June. In recent years there has been interest by mid season prime lamb producers in including alternative forages, particularly tyfon, when reseeding pasture for weaned lamb finishing. Tyfon is a brassica, a cross between stubble turnip and chinese cabbage. It only survives for one season and provides up to three grazings with most of the forage produced in the first rotation.

Chicory is a perennial forage crop with a deep tap root that is tolerant to drought. There is evidence that it may have anthelmintic properties consequently reducing internal parasites in sheep. Chicory has a persistency of up to five years depending on sward management. A recent study was undertaken at Athenry to evaluate the effects of reseeding and the use of alternative forages, namely tyfon and chicory, on lamb performance post-weaning.

Grazing Study

The effects of tyfon and chicory, grazed either as pure stands or in combination with perennial ryegrass, on lamb performance post weaning were evaluated in a recent grazing study at Athenry. The performance of lambs grazing old permanent pasture was the bench mark to determine the benefits from reseeding. Paddocks were ploughed and seeded on 29 May to give the following treatments:

(i) Perennial ryegrass (PRG);
(ii) Chicory plus PRG;
(iii) Tyfon plus PRG;
(iv) Chicory; and,
(v) Tyfon.

A sixth treatment consisted of old permanent pasture.

The perennial ryegrass mixture was based on intermediate heading varieties. The grass seed mixture was Aberdart, Aberstar, Greengold and Dunluce at 2.5, 9.9, 7.4 and 7.4kg/ha, respectively. In addition, Chieftain and Crusader varieties of clover were included at 1.2kg and 1.2kg/ha, respectively in the seed mixture.

When chicory or tyfon was included they displaced 3.7 kg/ha of the grass seed mixture. When grown as pure stands, chicory and tyfon were seeded at 6.2 kg/ha.

The old permanent pasture had been grazed by ewes and lambs for the previous 10 years, and had been used recently for extended grazing. Its botanical composition was: meadow grass 39%, perennial ryegrass 27%, cocksfoot 11%, clover 8%, timothy 8% and weed species 7%.

Table 1: Effect of sward type on lamb performance

	Sward type					
	Perennial ryegrass (PRG)	**Tyfon + PRG**	**Tyfon only**	**Chicory + PRG**	**Chicory only**	**Old permanent pasture**
Live weight gain(g/d)	226	220	213	190	226	219
Kill out (%)	42.1	42.6	42.9	43.2	43.4	42.1

(Keady and Hanrahan 2010)

Studies at Athenry have shown that including tyfon in the reseed had no beneficial effect on lamb performance or stock carrying capacity

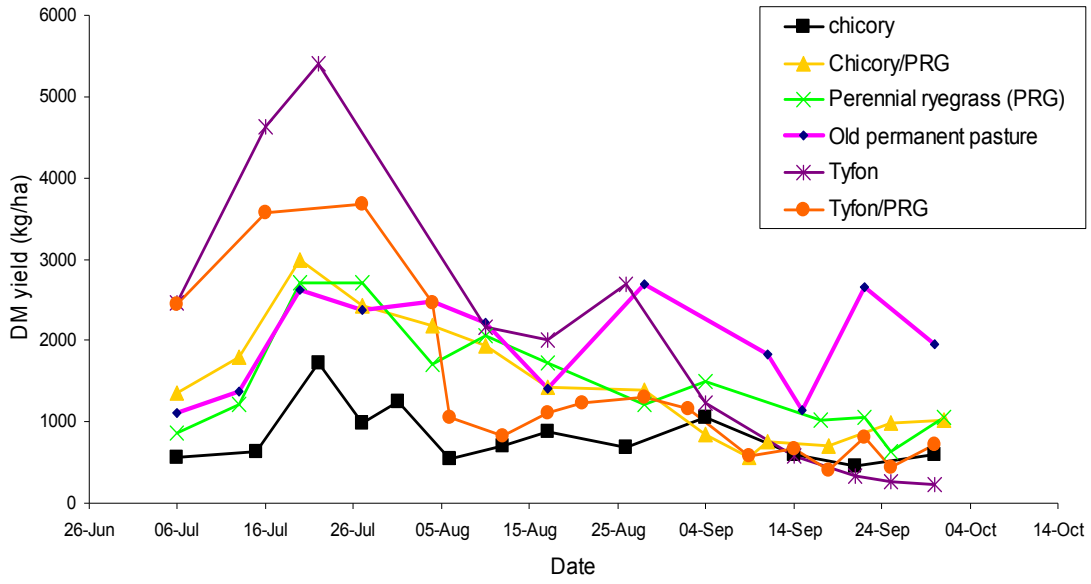
Weaned lambs commenced grazing the experimental treatments from 7 July and were drafted for slaughter every three weeks. Lamb performance is presented in Table 1. High levels of lamb performance were achieved across all treatments, the average daily live weight gain being 217g/day. Lambs grazing the old permanent pasture produced the same daily live weight gain as the lambs on the new perennial ryegrass sward. Relative to the new perennial ryegrass sward, including chicory in the seed mixture reduced live weight gain by 36g/day, consequently increasing the number of days to reach slaughter weight. However, kill-out percentage was increased by 1.2% units. Including tyfon in the seed mixture had no effect on lamb performance. Grazing pure stands of either tyfon or chicory did not affect performance relative to lambs grazing the new perennial ryegrass pasture or the old

permanent pasture. Lambs which grazed either the old permanent pasture, new perennial ryegrass sward and tyfon plus perennial ryegrass sward were drafted for slaughter at similar frequencies.

High levels of lamb performance post-weaning can be achieved from well-managed permanent pastures

The distribution of herbage yield during the grazing season was influenced by the reseeding treatment (Figure 1). For example, the new perennial ryegrass sward and the swards which included either chicory or tyfon produced the same total dry matter yield during the grazing season. However, the swards containing tyfon produced higher yields during the first rotation but lower herbage yields during the subsequent rotations. For example, the sward containing tyfon produced 200%, 62%, 55% and 69% of the forage produced in the perennial ryegrass sward during rotations 1,2,3 and 4, respectively. The corresponding values for the sward containing chicory were 129%, 101%, 83% and 90% respectively. Tyfon grown as a pure stand produced a heavy yield in the first rotation, but lower yields in subsequent rotations. The pure stand of chicory produced consistently low yields throughout the study, producing 74%, 41%, 55% and 63% of the forage produced in the perennial ryegrass sward during rotations 1, 2, 3 and 4, respectively.

Herbage utilisation is one of the major factors affecting the cost of forage production. In the current study, to maintain reasonable herbage utilisation, it was essential to graze the swards containing tyfon tight to reduce the quantity of leaf remaining on the ground. Also, it was noted that including tyfon in the grass seed mixture resulted in open swards, subsequently reducing herbage production later in the season with a possible negative impact on sward botanical composition.



(Keady and Hanrahan 2010)

Figure 1: Effects of sward type on pre-grazing herbage DM yield

The effect of sward type on lamb grazing days has a major impact on stock carrying capacity, and therefore, on live weight gain per hectare **(Table 2).** In the reseeded pastures, relative to perennial ryegrass, including either chicory or tyfon in the seed mixture reduced lamb live weight gain per hectare by 7 and 10%, respectively. Whilst use of chicory as a pure stand resulted in the same lamb daily live weight gain as perennial ryegrass **(Table 1),** live weight gain per hectare was reduced by 42% due to lower herbage production.

Table 2: Effect of sward type on lamb output per hectare (relative to PRG)

	Sward type				
	Perennial ryegrass (PRG)	**Tyfon + PRG**	**Tyfon only**	**Chicory + PRG**	**Chicory only**
Lamb grazing days	100	94	92	99	56
Live weight gain (kg/ha)	100	90	87	93	58

Keady and Hanrahan (2010)

Experience on a Commercial Farm

A study was undertaken, by Ciaran Lynch, Technologist, Teagasc Sheep BETTER Farm Programme, on one of the Sheep BETTER Farms to evaluate the effects of including tyfon in a grass reseed on subsequent lamb performance. From the on-farm study it was concluded that including tyfon in the

grass reseed had no beneficial effects on lamb performance. Furthermore, including tyfon in the reseed reduced the number of grazing days per hectare by 19% (Table 3).

Grass becoming established following the first grazing of tyfon

On the on-farm study it was also concluded that including tyfon in the reseed increased forage yield in the first and second rotations but reduced forage yield in the third and fourth rotations. The results of the on-farm study confirm those of the Athenry study that including tyfon in a reseed had no beneficial effects on lamb performance or on stock carrying capacity.

Table 3: Effects of sward type on stock carrying capacity on a commercial farm

	Sward type	
Variable	**Perennial ryegrass (PRG)**	**Tyfon + PRG**
Total grazing days per hectare	3763	3060
No. of lambs per hectare per day	45.9	37.3

Lynch et al. (2009)

Summary

1. Old permanent pasture sustained the same high level of lamb performance (live weight gain of 219 g/day) as reseeded pasture.
2. Including tyfon in the reseed had no beneficial effect on lamb performance or stock carrying capacity.
3. Including chicory in the reseed reduced daily live weight gain but kill out percentage was improved.
4. On many sheep farms greater performance can be achieved from improved grazing management of existing swards.
5. On sheep farms, if reseeding, the priority should be to establish dense productive swards based on perennial ryegrass and clover.
6. Reseeding should occur from July onwards when herbage demand is lowest after lambs are weaned and winter forage requirements have been conserved. Reseeding at this time will provide high feed value grass for finishing lambs during the autumn.

References

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Feed Ingredient Options for Sheep Rations

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Concentrate feeds are made up of different constituents. Each constituent provides the animal with different nutrients and has a certain function within the overall diet. All foods contain water and dry matter. The dry matter of the food contains the main constituents required by the animal i.e. carbohydrates, proteins, fats, vitamins and minerals. Carbohydrate in feed comes in the form of starch or sugar or fibre. Animals get most of their energy from carbohydrate, with a small percentage of their energy coming from fat.

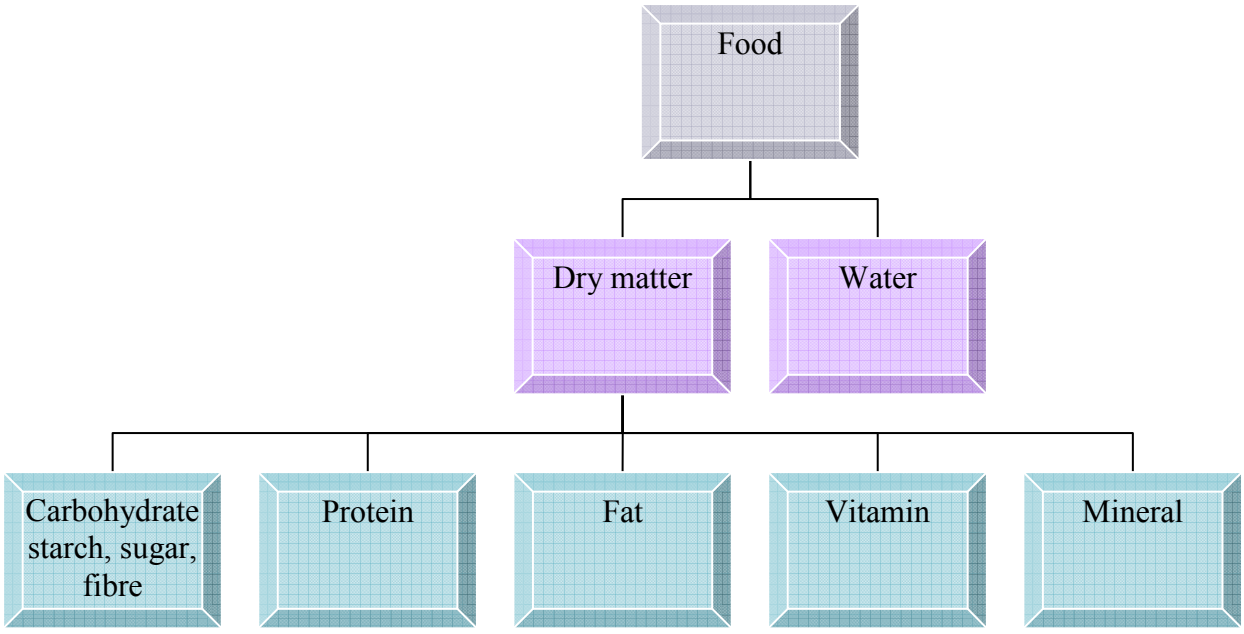

Figure 1. Constituent breakdown of concentrate feed.

Energy is the most limiting nutrient in sheep rations. Always ask for the energy content of the ration, before purchase. The target energy density of sheep rations is 0.94 UFL/kg as fed.

Common Feed Ingredients

Energy Feeds

Barley is a rich source of starch for sheep rations. Barley is a high energy feed with low protein (10% CP). There is no maximum inclusion rate in a sheep ration. Whole barley is commonly used in sheep rations and this reduces the risk of acidosis. Barley can be included at up to 40% of the ration, assuming it's correctly balanced for fibre, minerals and protein.

Wheat is a good source of energy in the form of starch but the starch is readily digested and therefore can cause digestive upsets. Its inclusion should be limited to 20% of the ration.

Oats has a 10% lower energy value than barley. This is due to a higher fibre content of oats. For this reason oats is a very safe feed for sheep. There is no maximum inclusion level but if the target is to achieve a high energy ration, then it's inclusion needs to be limited.

Beet pulp is a by-product from the sugar beet industry. Most of the beet pulp utilized in this country is now imported from the UK. It is high in digestible fibre which is an energy source. It is palatable and ideal for mixing with cereals. There is no maximum inclusion.

Citrus pulp is a by-product from the extraction of orange from citrus fruits including oranges and lemons. It is high in digestible fibre but low in protein (6% CP). It has a poor mineral balance and its inclusion should be limited to not more than 30% of the ration.

Soya hulls is a by-product of soya bean processing. It is a medium energy feed with low protein (10% CP). It is available in meal or pelleted form. The pelleted form is best. It's a good source of fibre buts its inclusion (20-25%) should be limited due to it's energy content.

Wheat feed (pollard) is a by-product of flour manufacture. It is a low energy feed with 16% crude protein. Its inclusion should be severely limited, particularly if other low energy feeds are used.

Molasses is a source of sugar in the diet of sheep. Cane molasses is commonly used in this country. It has a relatively low energy and protein content. It is used to ensure pellet integrity and reduce dust in coarse rations. It is generally included in rations at 4-6%.

Vegetable fat is a source of energy in animal feed but is used in very small quantities, relative to the cereals and pulps. Its inclusion should be limited as high levels of unprotected fat can reduce fibre digestibility and consequently, intake.

Protein Feeds

Soya bean meal is the "Rolls Royce" of protein feeds. The soya commonly used in this country has 48% CP. The protein is of good quality with a high proportion of by-pass protein. It is an ingredient of consistent quality and useful for home mixing. Its inclusion is generally limited by price.

Distillers grains is a by-product from the distillery industry. Corn (or maize) distillers grains, imported from the US, is commonly used in the country. But other sources include barley and wheat distillers grains from the UK and Europe. It is high in protein (26% CP) and energy. However, due to high concentrations of copper levels, its inclusion in a ration should not exceed 30%.

Maize gluten feed is a by-product of the manufacture of maize starch. It is a moderate protein source (20% CP) but its protein quality can be variable. Due to high concentrations of copper a maximum inclusion rate of 30% is advisable.

Rapeseed meal is a by-product of oil manufacture. It is a medium energy, high protein (34% CP) feed. Its inclusion should be limited to 20% of the ration due to palatability issues.

Sunflower meal is a by-product of oil manufacture. It is a very poor energy source and while its crude protein is 25%, the quality of the protein is poor. Its inclusion should be severely limited, particularly if other low energy feed are being used in the ration.

Peas are a good source of energy and moderate source of protein (21% CP). Inclusion rate should be limited to 20-25% due to anti-nutritional factors.

Beans are a good source of energy and protein (25% CP). Beans are commonly used to replace distillers grains in rations. The inclusion rate should be limited to 20-25% due to anti-nutritional factors.

Minerals & vitamins are a necessary component of any sheep ration. Inclusion rate will vary from 2-4%. Always check that the mineral correctly balances the ingredients used.

Table 1 presents the energy and protein content of a range of feed ingredients. The energy content of the feed ingredient is expressed in UFL's. Barley has an energy value of 1.00 UFL and all other ingredients are expressed relative to barley.

Table 1: Energy & Protein Content of Common Feed Ingredients

Feed/Ingredient	Energy (UFL)	Protein (%)
Energy Feeds		
Barley	1.0	9.7
Maize meal	1.05	8.7
Beet pulp	1.0	8.8
Citrus pulp	1.0	6
Soya hulls	0.88	10.5
Wheat feed (pollard)	0.77	16.2
Molasses	0.74	4.5
Protein Feeds		
Soyabean meal	1.02	48
Distillers grains	1.03	26.6
Rapeseed meal	0.91	34
Maize gluten feed	0.90	20
Sunflower meal	0.58	24.6
Peas	1.03	21.0
Beans	1.01	24.6

How to: Calculate the Monetary Value of an Energy Feed, Relative to Barley

On an energy basis, all feeds are expressed relative to barley. Barley has an energy value of 1,00 UFL / kg as fed. Therefore, if a feed ingredient has a UFL = 0.88 / kg as fed, then its monetary value is 88% of the value of barley. Likewise, if an ingredient has a UFL = 1.05, then its monetary value is 105% of the value of barley, based on energy content.

Example

How do I calculate the monetary value of soya hulls, when rolled barley is €230/t ?

1. Soya hulls has a UFL of 0.88/kg as fed. Therefore, it is valued at 88% of the value of barley
2. To get the monetary value of soya hulls, multiply the price of barley by (0.88/1.0)

   = €230 * (0.88 / 1.0)

   = €230 * 0.88

   = €202

This calculation takes no account of protein, mineral or fibre content of the ingredient

Sample Rations

Table 2 presents sample rations suitable for ewes pre-lambing and finishing lambs.

Table 2: Sample Rations

	Ewe Pre-Lambing	Lamb Finishing
Barley (%)	40	40
Beet pulp (%)	28.5	34.5
Soyabean meal (%)	26	
Rapeseed meal (%)		20
Molasses (%)	3	3
Minerals (%)	2.5	2.5
Energy (UFL)	0.97	0.95
Crude protein (%)	19.0	13.8

The mineral content of the ration is just one of the risk factors associated with urinary calculi. High levels of salt are regularly included in rations to encourage water intake and reduce the risk of urinary calculi. A Ca/P ratio of 2/1 or more is desirable.

Summary

1. The constituents of sheep rations include energy (carbohydrate & fat), protein, minerals & vitamins.
2. Energy is the most limiting nutrient in sheep rations. Always ask for the energy content of the ration, before purchase. The target energy density of sheep rations for high producing animals is 0.94 UFL or greater.
3. The primary high energy sources used in sheep rations include cereals and pulps (beet pulp and citrus pulp). Low energy ingredients should be avoided, particularly when home mixing.
4. Soyabean meal is the "Rolls Royce" of protein feeds and because of its consistent quality is most suited to home mixing. Other reliable protein sources include distillers grains (watch for copper levels) and rapeseed meal (watch for palatability issues).
5. The monetary value of energy feeds should be calculated on the basis of their energy value, relative to standard barley.

Common ingredients

Energy feeds	Comments	
Barley	High starch, risk of acidosis at high feeding rates.	
Wheat	High starch and rapidly digestible, higher risk of acidosis than with barley or maize.	
Maize grain	High starch but slowly digestible, risk of acidosis less than barley or wheat.	
Citrus pulp	Good source of digestible fibre and sugar.	
Beet pulp	Good source of digestible fibre and high energy.	
Soya hulls	Good source of digestible fibre, and moderate energy content.	
Wheat feed (pollard)	By-product from flour processing and low energy feed. Avoid usoing this product at high inclusion rates.	

Molasses	Useful for binding pelleted concentrates, reducing dust and improves palatability of concentrate mixes. Typical inclusion of 3-6% in the concentrate mix.	

Protein Feeds

Maize distillers grains	High energy and moderate protein feed. Can be hugh in copper.	
Maize gluten feed	Moderate energy, moderate protein, variable quality.	
Rapeseed meal	High protein, a good source of rumen degradable protein, palatability issues at high inclusion rates.	
Palm kernel meal	Low energy feed; limit its use in high energy mixes. Avoid using this product at high inclusion rates.	
Sunflower meal	Low energy feed, high protein content but protein is of poor quality. Avoid using this product at high inclusion rates.	
Soyabean meal	The best quality protein feed and high in by-pass protein.	

Nutrition in Late Pregnancy in the Foundation to Flock Profitability

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The plane of nutrition during late pregnancy has a major influence on lamb birth weight, lamb vigor and survival, colostrum production, and ewe body reserves; all of which impact on subsequent lamb weaning rate and weaning weight. Consequently, appropriate nutrition and management during late pregnancy is one of the keys to profitable mid-season lamb production. The optimum plane of nutrition in late pregnancy should result in the birth weight of single, twin and triplet lambs of 6.0, 5.0 and 4.0kg, respectively. Previous studies at Athenry have clearly shown that each 1kg increase in lamb birth weight increases subsequent weaning weight by 3.2kg. The price of concentrate has increased considerably in recent times. Therefore, it is essential to maximise the return to concentrate feeding by feeding the optimum level, which is dependant on forage quality and the expected litter size. The aim of this paper is to summarise results from recent studies at Athenry on the effects of late pregnancy nutrition on lamb birth weight and subsequent growth rate.

Foetal Development

At eight weeks prior to lambing, whilst the placenta is fully developed, the foetus is only approximately 15% of its ultimate birth weight. The weight of the foetus increases by 70, 50 and 20% of its birth weight during the last six, four and two weeks prior to lambing, respectively. At the point of lambing the lamb(s) account for approximately 60% of the weight of the uterine contents. Consequently, a ewe which produces twin lambs, each weighing 5kg, looses approximately 17kg weight at lambing.

Nutrient Requirements

Due to the rapidly growing foetuses and udder development (for colostrum production) the metabolisable energy (ME) requirement of ewes carrying singles, twins and triplets increases by 40, 60 and 70%, respectively, over the final six weeks of pregnancy. Thus, for example, the ME requirement of a twin-bearing ewe weighing 75kg increases from 12 to 19 MJ daily. Considering that 1kg of barley (14% moisture) contains only 11.5 MJ of ME, ewes need to be well supplemented in late pregnancy. Whilst ewes in good condition in late pregnancy can mobilise some body condition those which are in poor condition must be fed to ensure that they maintain adequate body reserves for early lactation. Ewes which are in poor condition at lambing partition a greater proportion of food energy

intake post lambing to replenishing body reserves, consequently, reducing milk energy production and consequently lamb growth rate.

As the demands for nutrients increase in late pregnancy supplementation should be stepped up weekly over the weeks immediately prior to lambing. Whilst excessive supplementation is wasteful it is essential to supplement with adequate levels of concentrate to meet requirements to ensure that lamb birth weight and lamb viability are not compromised, and that adequate supplies of colostrum are produced, whilst at the same time reducing labour requirement at lambing. Silage type, silage feed value and litter size are the main factors which impact on concentrate requirements during pregnancy.

Impact of Silage Feed Value

The majority of ewes that are housed are offered grass silage as the sole forage whilst indoors. The major factors that affect the feed value of grass silage for sheep are digestibility and chop length.

Digestibility: Digestibility is the most important factor in grass silage affecting animal performance as it is positively correlated with energy concentration and intake characteristics. Previous studies clearly show that each five percentage-unit increase in digestibility increases milk yield of dairy cows by 1.85kg/day, carcass gain of finishing beef cattle by 21kg over a 150-day finishing period, and the carcass gain of finishing lambs by 1.9kg over a 50-day finishing period. A study was undertaken at Athenry to evaluate the impact of silage digestibility on the performance of pregnant ewes, and of their progeny until weaning at 14 weeks. The results are presented in Table 1.

Table 1: The affects of grass silage feed value and concentrate feed level in late pregnancy on ewe and subsequent lamb performance

	Silage DMD (%)		
	73	**79**	
Concentrate (kg/ewe in late pregnancy)	**20**	**5**	**20**
Ewe weight post lambing (kg)	61.4	70.4	73.6
Lamb - birth weight (kg)	4.6	4.9	5.1
- weaning weight (kg)	32.9	34.0	34.7
- gain – birth to weaning (g/d)	292	301	306

(Keady and Hanrahan 2009)

Increasing silage digestibility, when offered at similar levels of concentrate, increased ewe live weight post lambing by 12.2kg, lamb birth weight by 0.55kg and lamb weaning weight by 1.8kg. The increase in lamb weaning weight reduced age at slaughter by about 2 weeks, consequently the price received

per kilogram of carcass was higher, as carcass price generally declines as the season progresses. An alternative way to evaluate silage feed value is to determine how much concentrate supplementation is required to yield lambs of a similar birth weight. In the current study, ewes offered the high feed value (high DMD) grass silage and supplemented with 5kg concentrate (soya bean meal plus minerals and vitamins) produced lambs that were heavier than the lambs from ewes offered the medium feed value silage supplemented with 20kg concentrate. Therefore, the high feed value grass silage enabled concentrate supplementation to be reduced by at least 75%.

Grass silage feed value, as determined by digestibility and intake characteristics, is the major factor affecting ewe performance during the housing period

Chop length: Unlike for beef and dairy cattle, chop length impacts on silage intake by sheep. In Ireland today approximately 55% of silage on sheep farms is ensiled in big bales. A study was undertaken at Athenry to evaluate the impact of harvest system (precision chop or big bale) on ewe and subsequent lamb performance, the results of which are presented in Table 2. Ewes offered silage,

during mid and late pregnancy, which was precision chopped produced lambs that were 1.8kg heavier at weaning.

Table 2: The effects of silage system on ewe and subsequent lamb performance

	Silage harvest system			
	Precision chop		Big bale	
Concentrate (kg in last 6 weeks of pregnancy)	**18**	**27**	**18**	**27**
Ewe condition at lambing	4.1	4.1	4.0	4.1
Lamb - birth weight (kg)	4.7	4.9	4.5	4.9
- weaning weight (kg)	33.7	34.8	32.1	32.8

(Keady and Hanrahan 2008)

Silage Type

In recent years the area of maize grown for ensiling has increased dramatically. Previous studies have shown that the use of maize silage increases milk yield of dairy cows and carcass gain of beef cattle by 2.1kg per cow per day (8%) and 0.11kg per head per day (19%), respectively (Keady 2005). Maize can be sown in the open (sown in early May using early maturing varieties) or under the complete cover plastic mulch system (sown early April using later maturing varieties). Results from Athenry, over three consecutive years, have shown that the average increase in dry matter yield was 40% due to the use of the complete cover plastic mulch system relative to growing the same variety of maize in the open.

Currently there is interest in feeding maize silage to pregnant ewes. Two studies have been completed at Athenry to compare grass silage with maize silage. Maize silage is lower in crude protein relative to grass silage. In both studies, some ewes received either 0 or 200g soyabean daily from housing to lambing. In addition all ewes were offered 16kg concentrate during the last six weeks of pregnancy. The results are summarised in Table 3.

Table 3: The effects of maize silage during late pregnancy on ewe and subsequent lamb performance

	Silage type		
	Grass	Maize	
Soyabean meal (g/day)	**0**	**0**	**200**
Ewe condition at lambing	3.8	3.5	4.0
Lamb – birth weight (kg)	4.7	4.5	4.9
- weaning weight (kg)	33.4	33.6	33.3

(Keady and Hanrahan 2008, 2009)

Relative to high feed value grass silage, maize silage offered without soyabean supplementation did not alter ewe condition at lambing or lamb birth or weaning weights. Supplementation with soyabean meal increased ewe condition at lambing and tended to improve lamb birth weight. However, provision of soyabean meal (200g/ewe daily) throughout the housing period did not alter lamb weaning weight.

The effect of maturity of maize at harvest was also evaluated in two studies, the results of which are presented in Table 4.

Table 4: The effects of maturity of maize at harvest on ewe and subsequent lamb performance

	Maize silage dry matter at harvest (g/kg)	
	200	**293**
Ewe condition at lambing	3.7	3.8
Lamb – birth weight (kg)	4.7	4.7
- weaning weight (kg)	32.7	33.8

(Keady and Hanrahan 2008, 2009)

The low and high dry matter maize silages were ensiled at dry matter concentrations of 200 and 293g/kg, respectively. Increasing maturity of the maize silage at harvest tended to increase ewe condition at lambing and increase lamb weaning weight by 1.1kg. Since maize silage has lower mineral and vitamin concentrations relative to grass silage ewes offered maize silage as the sole forage should receive 50% extra sheep mineral and vitamin mixture relative to ewes offered grass silage to avoid risk of any deficiency.

Concentrate Feed Level

Silage feed value (as determined by digestibility, chop length and intake characteristics) and litter size are the major factors affecting the amount of concentrate supplementation required by ewes in late pregnancy. When supplementing ewes the objective is to produce heavy lambs (which will be delivered unassisted) and ewes with adequate supplies of colostrum. With good quality silage there is no benefit from feeding excess concentrate to ewes in late pregnancy (Table 1). However with medium feed value silage increasing the amount of concentrate offered to ewes in late pregnancy increased lamb birth weight and subsequent weaning weight (Table 2).

The effects of silage feed value on concentrate requirements of twin-bearing ewes in late pregnancy are presented in Table 5.

Table 5: Effects of silage quality on concentrate requirements of twin-bearing ewes in late performance

	Silage DMD (%)		
	79	**72**	**64**
Precision chopped (kg/ewe)	8	12	20
Big bale/Single chop (kg/ewe)	12	20	30

Concentrate requirements are influenced by both silage digestibility and harvest system (chop length). The rate of increase in the level of concentrate supplementation required increases as silage digestibility (DMD) decreases. Furthermore, as silage chop length increases, the quantity of additional concentrate required increases because digestibility declines. For example, for silages at 79 and 65% DMD an additional 4 and 10kg concentrate are required for long chop length silages, relative to precision chop silages, respectively. For ewes carrying singles, concentrate supplementation can be reduced by approximately 5kg/ewe, whilst for ewes carrying triplets concentrate supplementation should be increased by 8kg .

Protein Source and Concentration

For prolific flocks the concentrate should be formulated to contain 190g of crude protein per kilogram (ie 19% crude protein) as grass silages on many sheep farms have low protein concentration.

Table 6: Sample concentrate mixes for ewes in late pregnancy (kg/t)

Ration	Ingredients	% Protein
1	355 barley, 140 citrus pulp, 200 soya hulls, 280 soya, 25 minerals & vitamins	19.0% protein
2	200 barley, 175 maize meal, 200 citrus pulp, 100 soya hulls, 300 soya, 25 minerals & vitamins	19.3% Protein
3	285 barley, 180 maize meal, 200 soya hulls, 190 soya, 120 rape seed, 25 minerals & vitamins	18.9% Protein
4	375 barley, 190 soya hulls, 200 maize gluten, 210 soya, 25 minerals & vitamins	19.0% protein

Soyabean meal is probably the best quality vegetable protein source and is widely available; consequently it should contribute a large proportion of the protein in concentrate offered to ewes in

late pregnancy. As the quantity of concentrate offered to ewes in late pregnancy is modest (depending on silage quality) it should contain high quality energy (barley, maize meal, wheat) digestible fibre (sugar beet pulp, citrus pulp, soya hulls) and protein (soybean, rape meal, distillers) sources. Relative to barley and soyabean meal, straights that are normally value for money include barley, corn gluten, maize meal, distillers, soya hulls and rape seed meal. However as soybean is probably the best source of protein available it should be included so as to provide a large proportion of the protein in rations to be offered to ewes in late pregnancy. Examples of simple, high quality rations are presented in Table 6. When purchasing a ration it is important to purchase on known ingredients as well as price.

Concentrate Feeding Management

Whilst the price of concentrate has increased substantially in recent years, it is essential to feed adequate levels to meet the ewe requirements in late pregnancy. Consequently, to optimise the use of concentrate ewes should be penned according to predicted litter size (base on ultrasonic scanning) and expected lambing date (penned according to raddle colour). The feed schedule required to offer ewes different concentrate feed levels varying from 10 to 45kg per ewe in late pregnancy is shown in Table 7.

Level of concentrate supplementation offered to ewes in late pregnancy should be based on lambing date, forage quality and expected litter size

Table 7: Daily concentrate allowance (kg/ewe daily) required for different total concentrate inputs prior to lambing

Week prior to lambing	Desired total concentrate input prior to lambing (kg/ewe)					
	10	**15**	**20**	**25**	**35**	**45**
8						0.4
7					0.4	0.6
6		0.2	0.3	0.4	0.5	0.6
5		0.2	0.3	0.4	0.6	0.8
4	0.2	0.2	0.4	0.6	0.7	0.9
3	0.2	0.3	0.5	0.6	0.8	1.0
2	0.4	0.5	0.6	0.7	1.0	1.0
1	0.6	0.75	0.8	0.9	1.0	1.1

During the week prior to lambing ewes receive up to 1kg/ewe daily, clearly illustrating the benefits of penning ewes according to expected lambing date as well as expected litter size.

Summary

1. Correct nutrition during late pregnancy is a key foundation to flock profitability.
2. Grass silage feed value, as determined by digestibility and intake characteristics, is the major factor affecting ewe performance and subsequently efficiency of production, during the housing period.
3. Reducing silage chop length increases ewe and subsequent lamb performance.
4. High feed value grass silage can reduce concentrate requirement by at least 75%, whilst maintaining animal performance.
5. Level of concentrate supplementation offered to ewes in late pregnancy should be based on lambing date, forage quality and expected litter size.
6. Supplement with a concentrate containing 19% crude protein and where soyabean meal accounts for a high proportion of the protein.
7. Maize silage can replace grass silage. However, extra mineral and vitamin supplementation is required. Also feed a concentrate with higher protein concentration (22%) in late pregnancy.
8. Pen ewes according to expected litter size and lambing date to minimise concentrate usage.

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High Concentrate Diets for Ewes in Late Pregnancy

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The need for silage or hay for your ewes in late pregnancy can be reduced or eliminated by the strategic use of concentrates. This was demonstrated by work carried out some years ago by Teagasc regarding the use of all concentrate diets for pregnant ewes. Some farmers have been operating a similar system in recent years with silage requirements reduced dramatically. The question of replacing silage with high levels of concentrates becomes important particularly in a year when silage is scarce, and or of poor quality. Some farmers are also operating this system on the basis that it saves them considerably on labour. However, when concentrates are relatively expensive it is less attractive. Furthermore, most farmers feel more comfortable with the traditional feeding programme of a silage-based diet supplemented with concentrates.

Teagasc Studies

In a study carried out by Teagasc at Knockbeg in 2001 ewes were offered one of three diets in the final six weeks of pregnancy. All ewes were housed on straw. The diets compared were:

- Diet 1 consisted of 77 DMD silage plus a total of 20 kg concentrates fed in late pregnancy **(D1)**
- Diet 2 was 60kg of a pelleted concentrate fed over the same period **(D2)**
- Diet 3 was 60kg a cereal based loose mix, mixed on farm and fed over the same period **(D3)**

In the week before the trial started, ewes allocated to the complete concentrate diet were introduced to concentrates with some silage also fed. The daily allocation of concentrate was increased gradually to 1kg per ewe by the end of the week with a gradual withdrawal of silage. Once the actual six week period began ewes were fed once per day the amounts outlined in Table 1.

Feed Costs

The data outlined in Table 2 shows the level of meal and silage consumed in the trial. The cost of these systems at today's prices can be compared by completing the cost column below. There is usually a large variation in prices quoted for rations. While some savings can be made by shopping around for value it is equally important to ensure that good quality ingredients are used in the rations fed. Diet D3 above consisted of a three way mix with 50% whole barley, 30% molassed sugar beet pulp and 20% soya bean

meal. A mineral/vitamin mix was added at the rate of 20g/ewe/day. It should also be recognised that the silage offered in diet D1 was high quality,

being approximately 77% DMD. On many farms silage quality is much poorer than this. If the silage being fed is of poor quality, performance will be poor or extra concentrates will be required, further increasing the cost of the conventional system. Furthermore, there is a huge variation in the price of silage. If buying silage, the total cost should include the cost of delivery.

Producers should carefully examine the cost of purchased hay/silage relative to meals.

Table 1: Dietary treatments in late pregnancy (kg/ewe/day)

Diet Fed		Weeks pre lambing		
		6 - 5	**4 - 3**	**2 - 1**
D1	Silage	Ad libitum	Ad libitum	Ad libitum
	+ Concentrate	0.2	0.4	0.6
D2	Pelleted concentrate	1.2	1.4	1.6
D3	Loose mix concentrate	1.2	1.4	1.6

From: Flanagan (2002) Easy Feeding of Housed Sheep

Labour

The labour index in Table 2 was based on the amount of work involved in feeding with each system, compared with the conventional system (index = 100). It can be seen from Table 2 that with the high concentrate diets, labour input was reduced by 60% with the pelleted ration. When the diet was a loose mix the labour reduction was less as the ingredients were mixed on the farm. However, it should be remembered that loose concentrates are regularly purchased ready mixed, in which case labour demand for feeding will be similar to that for pelleted formulations.

Other Issues

In the Knockbeg work lamb birth weight was 0.4 to 0.6kg higher for the lambs from ewes fed the all concentrate diets. This did not cause any increased problems at lambing or subsequently as mortality was not affected and lamb survival rate was the same for all three groups. Furthermore, evidence from Teagasc, Athenry indicates that an increase in birth weight results in higher lamb growth rate and subsequently higher weaning weight. Ewe live-weight was increased in the all concentrate fed ewes. However, this was mainly due to large weight increase in ewes carrying singles. Therefore, it is recommended to feed single and multiple carrying ewes separately and feed according to requirements.

Table 2: Feed levels of ewe diets in Teagasc trials in 2001 with labour index for each diet in final six weeks of pregnancy

Diet	Diet Details	Calculate Cost	Labour index
D1	Silage 0.25t (est. 0.3 bale)		
	Conc. 20 kg		
	Total for D1		100
D2	Conc. 60 kg (pelleted)		40
D3	Conc. 60 kg (home mix loose ingredients)		70

From: Flanagan (2002) Easy Feeding of Housed Sheep

Care must be taken to introduce meals gradually to avoid acidosis. Adequate trough space must be provided as well as a constant supply of clean water

Management Factors

To give all ewes an equal chance and to avoid digestive problems, adequate trough space is essential. Meals should be introduced and amounts increased gradually. Access to clean drinking water at all times is a must. It may be more appropriate to avoid feeding more than 0.4–0.5kg meal in a single feed. Access to a small level of roughage (silage, hay or straw) is recommended to help prevent digestive problems.

Advantages

The following are some of the advantages, as reputed by farmers, of feeding an all concentrate diet in late pregnancy:

- Very convenient;
- Ewe body condition is good at lambing;
- Lambs born healthy and strong;
- No problem with oversize lambs;
- Subsequent lamb growth rate is satisfactory;
- Land not tied up during summer to grow silage or hay;
- Very little time and costs spent making silage or hay. Frequently, the only silage made is from; surplus grass thereby maintaining grass quality for grazing lambs. Such silage is usually made from leafy grass and is of good quality; and ,
- Surplus silage can be sold.

Disadvantages

- An expensive option when concentrate prices are high; and
- Risk of acidosis in ewes when meals levels are increased too rapidly.

Summary

- Concentrate rations can replace silage as the main diet for ewes in late pregnancy. It is easy to manage and can significantly reduce labour requirements.
- When silage quality is poor or is scarce and the purchase price is high, feeding extra concentrates as an alternative becomes attractive.
- When concentrate prices are relatively high it is a less attractive option.
- Care must be taken to introduce meals gradually to avoid acidosis. Adequate trough space must be provided as well as a constant supply of clean water.
- When this is taken care of there should be no management or health problems.

Creep Feeding Concentrate to Lambs at Pasture – Does it Pay?

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The objective in mid-season prime lamb production is to achieve high levels of lamb performance in a cost effective manner. High levels of lamb performance can be achieved from well managed grazed grass offered as the sole diet. However, many producers supplement lambs with concentrate to increase lamb performance. The aim of this paper is to present information on the effects of concentrate supplementation on lamb performance. Furthermore, the effects of concentrate supplementation on projected financial margins, during the last 3 seasons, based on lamb drafting at Athenry and on a commercial farm are also presented.

Athenry Study

The lamb performance response to concentrate supplementation depends on grass supply and digestibility and on the level of concentrate offered. A four-year study which was undertaken at Athenry involved evaluating the effect of grass supply and concentrate feed level on lamb performance. The ewes used in the study were predominantly rearing twins as the number of lambs reared per ewe ranged from 1.7 to 1.9 during the four years of the study. The effects of the level of concentrate offered and grass availability, as determined by residual sward height in a set-stocked grazing system, are presented in Table 1.

Table 1: The effects of concentrate feed levels and grass availability on lamb performance from birth to slaughter

	Creep feed (g/lamb per day)					
	Low sward height (5 cm)			High sward height (6 cm)		
	0	300	600	0	300	600
Weaning weight (kg)	31.4	34.3	36.9	33.7	36.7	37.5
Drafted at weaning (%)	7.3	20.7	42.8	20.4	41.2	53.7
Age at sale (days)	167	140	125	154	126	118
Creep intake (kg)	0	32.5	52.9	0	27.5	46.0

(Grennan & McNamara, 2005)

The data presented in Table 1 clearly show that high levels of lamb performance were achieved from grazed grass as the sole diet in a set-stocked grazing system. Increasing concentrate feed level increased lamb performance and reduced the age at slaughter, regardless of sward height.

In mid-season prime lamb production systems, the increased carcass gain due to concentrate feeding does not cover the cost of concentrates.

Lambs offered up to a maximum of 300g or 600g concentrate/day consumed 30kg and 50kg concentrate, respectively, from birth to slaughter. Feeding 300g concentrate per lamb daily on the low sward height resulted in the same level of lamb performance pre-weaning as lambs grazing the high sward height without concentrate supplementation. Therefore, concentrate feeding replaced good grassland management. Concentrate feeding reduced the age to slaughter by 28 days. However, increasing grass height from 5cm to 6 cm reduced the age at slaughter by 13 days, equivalent to feeding 16.3kg concentrate per lamb from birth to slaughter. Previous studies at Athenry have shown that shearing ewes at housing increased subsequent lamb birth and weaning weights by 0.6 and 2.2kg respectively which is equivalent to the response to feeding 22kg concentrate per lamb from birth to weaning.

The data clearly shows that creep feeding concentrate increases lamb performance and reduces age at slaughter by 28 days. However, does concentrate feeding increase financial returns in a mid-season prime lamb production system as in Ireland most ewes lamb during March?

Financial Implications

The weekly price received per kg of lamb carcass (data supplied by Bord Bia) for the years 2007 to 2010 is presented in Figure 1. Whilst lamb carcass price declines as the season progresses most of the price decline has occurred by late June. To determine the potential financial implication of feeding concentrate it is essential to include the drafting information and individual carcass weight data for all lambs for the entire flock. The drafting data from flocks at Athenry and from a commercial flock for 2008, 2009 and 2010 are presented in Tables 2 and 3, respectively.

These flocks did not offer concentrate to lambs reared as singles or twins whilst lambs reared as triplets received up to 300g concentrate daily until weaning. To estimate the effect of concentrate feeding on financial returns, the carcass value received and estimated carcass value had the lambs being offered up to 300g concentrates daily and consequently slaughtered four weeks earlier (based on

lamb prices supplied by Bord Bia) are presented in Tables 2 and 3. The mean carcass weights for the lambs from the Athenry flock were 19.0kg, 19.1kg and 20.6kg, respectively for 2008, 2009 and 2010. The mean carcass weights for the lambs from the commercial flock were 21.8kg, 21.1kg and 21.7kg, respectively, for 2008, 2009 and 2010.

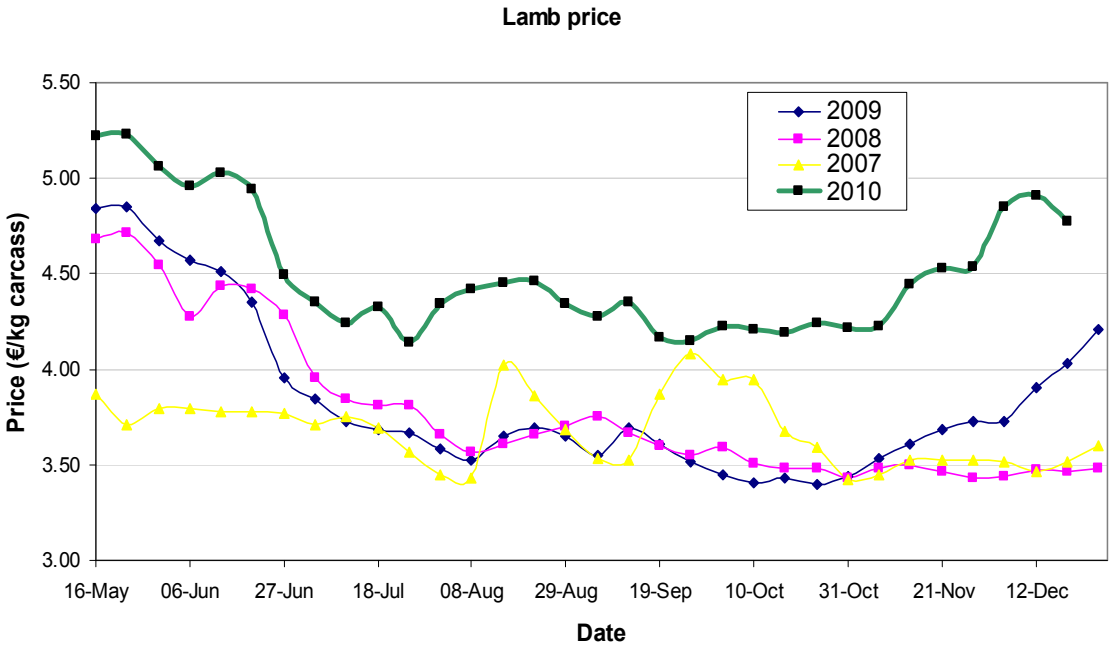

Figure 1. Lamb carcass price ((€/kg) during the seasons 2007 to 2010

The drafting data for the Athenry flock presented in Table 2 clearly show that if concentrate had been offered, the price received per kilogram of lamb carcass for the first and second draft of lambs would have been increased significantly. However, when the increased price which would have been received due to earlier drafting as a result of concentrate feeding was calculated across the whole flock, the increase in average carcass price was 17, 9 and 1 c per kilogram in 2008, 2009 and 2010, respectively.

To improve financial margins producers should focus on improving grassland management.

Table 2: The effects of concentrate feeding on lamb carcass value for the Athenry flocks 2008, 2009 and 2010

Year	No concentrate		Price (€/kg) at sale		
	Date	% Sold	No conc. offered	If offered concentrate**	Difference (c/kg carcass)
2008	25 June	21	4.28	4.54	+26
	25 July	44	3.80	4.28	+46
	8 Sept	69	3.66	3.60	-6
	6 Oct	87	3.50	3.66	+16
	4 Nov	100	3.50	3.59	+9
		Average	***3.73***	***3.90***	***+17***
2009	22 June	11	3.95	4.67	+72
	29 July	24	3.58	3.85	+27
	18 Aug	34	3.69	3.67	-2
	8 Sept	61	3.69	3.65	-4
	29 Sept	75	3.45	3.54	+9
	29 Oct	89	3.44	3.45	+1
	26 Nov	100	3.68	3.44	-24
		Average	***3.63***	***3.72***	***+9***
2010	17 June	4	4.94	5.23	+29
	1 July	6	4.36	4.97	+61
	20 July	13	4.14	4.41	+1
	12 Aug	25	4.46	4.32	-14
	12 Sept	55	4.26	4.46	+20
	30 Sept	70	4.23	4.28	+5
	4 Nov	84	4.22	4.21	-1
	7 Dec[$]	100	4.90	4.44	-46
		Average	***4.40***	***4.41***	**+1**

(Keady, 2010)

** offered up to 300 g concentrate/lamb daily thus reducing age at slaughter by 28 days

[$] Draft delayed due to extreme weather conditions

The drafting data for the commercial flock, presented in Table 3, clearly show that if concentrate had been offered, the price received per kilogram of lamb carcass was increased significantly for the first draft. However, when this increased price which would have been received due to the earlier drafting as a result of concentrate feeding was calculated across the whole flock, the increase in average carcass price was 2, 10 and 22 c per kilogram in 2008, 2009 and 2010, respectively.

Table 3: The effects of concentrate feeding on lamb carcass value for a commercial flock in 2008, 2009 and 2010

Year	No concentrate		Price (€/kg) at sale		
	Date	% Sold	No conc. offered	If offered concentrate**	Difference (c/kg carcass)
2008	3 July	6	3.95	4.27	+32
	22 Aug	29	3.66	3.66	0
	12 Sept	45	3.66	3.60	-6
	21 Oct	70	3.48	3.55	+7
	11 Nov	90	3.50	3.48	-2
	4 Dec	100	3.50	3.50	0
		Average	***3.60***	***3.62***	***+2***
2009	9 July	12	3.72	4.51	+79
	17 Aug	38	3.69	3.67	-2
	10 Sept	69	3.69	3.67	-2
	12 Oct	83	3.43	3.61	+18
	27 Nov	100	3.44	3.45	+1
		Average	***3.62***	***3.72***	***+10***
2010	15 July	37	4.33	4.94	+61
	22 Aug	54	4.34	4.34	0
	13 Sept	79	4.17	4.46	+29
	27 Sept	89	4.23	4.28	+5
	27 Nov	100	4.53	4.22	-31
		Average	***4.30***	***4.52***	**+22**

** offered up to 300 g concentrate/lamb daily thus reducing age at slaughter by 28 days

The data presented in Tables 2 and 3 clearly illustrate that whilst concentrate feeding reduced the age of slaughter by 28 days it had relatively marginal effects on the average price received per kilogram of lamb carcass for the whole flock. Lambs that are offered 300g concentrate daily consume 30kg of

concentrate prior to slaughter. The cost of concentrate consumed by lambs prior to slaughter is €7.00 or €9.00, when concentrate costs €250 and €300/t, respectively.

To recover the cost of concentrate, the break price at which concentrate would need to have been purchased was €108/t, €57/t, and €0/t for the Athenry flock and €0/t, €70/t and €144/t for the commercial flock in 2008, 2009 and 2010, respectively. Therefore for the two flocks, in each of the last three years, feeding concentrate to lambs at pasture was not economically justifiable because it could not be purchased at less than the break even price.

In the costing exercise no economic value was attributed to the grass which is not consumed due to earlier sale of lambs offered concentrate because the opportunity value of the grass on a sheep farm in the summer is relatively low. However, no cost has been included for the price of the feeders or the labour to feed the concentrate daily.

The data in Tables 2 and 3 shows that under market conditions which prevailed in 2008, 2009 and 2010, the extra carcass value received due to creep feeding in mid season prime lamb producing flocks did not even come close to covering the cost of concentrate offered. Therefore, to improve financial margins the majority of producers should focus on improving grassland management which is low cost, rather than trying to replace poor grassland management with concentrate which is an expensive solution and is guaranteed to reduce margins.

Summary

1. Concentrate supplementation at up to 300 g/lamb daily:
    - **a.** increases lamb performance;
    - **b.** reduces age at slaughter by 28 days;
    - **c.** increases price received for the first draft; and,
    - **d.** marginal effects on mean carcass price for the total flock.
2. In mid-season lamb production systems, the increased carcass value due to concentrate feeding does not cover the cost of the concentrate.

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Finishing Store Lambs During Winter: Which Diet to Offer?

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Approximately 20% of the annual lamb kill occurs during January, February and March, thus ensuring a continuous supply of lamb to the market. A large proportion of these lambs are finished on concentrate diets. However, the price of concentrates has increased dramatically in recent times. Use of ensiled forages may provide more cost effective methods of finishing lambs. The benefits of high feed-value grass silage in finishing beef cattle, producing liquid milk and feeding to pregnant ewes are well documented. However, there is little information on the benefits of high feed-value grass silage in the diet of finishing lambs.

Maize silage can be sown either in the open or under the complete plastic mulch system. In recent years due to developments in plant breeding and the complete-cover-plastic-mulch system, the yield potential and, consequently, the production, of maize silage has increased dramatically. The benefits of including maize silage in the forage component of the diet of finishing beef cattle and lactating dairy cows are well documented (Keady 2005, Keady et al 2007, 2008). Furthermore, recent studies at Athenry have shown that maize silage can replace grass silage in the diet of pregnant ewes (Keady and Hanrahan 2008 and 2009). A sizable quantity of maize silage is traded from arable to livestock farms. However, there is little information on the benefits of high feed-value maize silage in the diet of finishing lambs. The aim of this paper is to present data from a recent study undertaken at Athenry to evaluate the effects of concentrate feed level, forage type and forage feed-value on the performance of finishing lambs.

Athenry Study

A study was undertaken to evaluate the effects of maturity of maize at harvest, grass silage feed-value and concentrate feed level on lamb performance during finishing. Two maize silages differing in stage of maturity at harvest, and consequently dry matter and starch concentrations, were produced form the variety Benicia, either sown in the open or under complete-cover-plastic-mulch system. Use of the complete-cover-plastic-mulch system increased forage yield (by 42%) and the concentrations of dry matter and starch at harvest.

High and medium feed-value grass silages were harvested and ensiled precision chopped. Each of the four silages was offered *ad lib* supplemented with concentrate (0.2, 0.5 or 0.8kg/lamb daily). The concentrate offered to lambs receiving 0.2kg daily was mineralised soyabean meal. The concentrate offered to lambs receiving 0.5kg/day 0.8kg/d and *ad libitum* contained 16% crude protein and consisted of barley, citrus pulp, soyabean meal and maize meal. The lambs offered *ad libitum* concentrate were supplemented with 0.5kg/day of the high feed-value grass silage. All lambs offered the grass silage diets were supplemented with 20g minerals and vitamins daily whilst those offered maize silage diets received 30g minerals and vitamins daily. The 13 diets were offered to store lambs (which had been purchased at local marts), which were housed unshorn in slatted pens, for 76 days. All lambs were treated for internal and external parasites. The dry matter digestibility (DMD) of the low and high feed-value grass silages were 70% and 75%, respectively. The starch concentrations of the low and high DM maize silages were 4 and 28%, respectively.

Grass Silage Feed-Value and Lamb Performance

Digestibility is the most important factor affecting animal performance from grass silage. Previous studies have clearly shown that each five-unit increase in digestibility increased lamb birth weight, and reduce lamb age at slaughter by 0.5kg and 2 weeks, respectively. Furthermore each five-unit increase in digestibility increased milk yield in dairy cows and carcass gain of beef cattle by 1.85kg/day and 21kg over a 150 day finishing period, respectively. The average DMD of silages produced on Irish farms is 70% DMD which is similar to the DMD of the medium feed-value grass silage in the current study.

High levels of lamb performance were achieved from high feed-value grass silage supplemented with only 0.2kg concentrates / lamb/ day

The effects of silage feed-value on lamb performance during finishing is presented in Figure 1 and Table 1. The high feed-value silage resulted in higher levels of lamb performance regardless of concentrate feed level relative to the low feed-value silage . High levels of lamb growth rate (150g live weight gain/day) were achieved from the high feed-value silage supplemented with only 0.2kg concentrate. The response to increasing concentrate feed level was higher for the medium feed-value grass silage due to a lower forage substitution rate. Each 0.5kg increase in concentrate feed level increased total dry matter intake by 0.13 and 0.23kg and reduced silage intake by 0.31 and 0.21 for the high and medium feed-value silages, respectively. Consequently, increasing concentrate supplementation with the high feed-value silage resulted in concentrate displacing a larger proportion of silage in the diet. High feed-value silage reduces the quantity of concentrate required to achieve a given level of performance. The results of the study show that the high feed-value silage supplemented with 0.2kg concentrate daily produced the same level of daily carcass gain as the medium feed-value silage supplemented with 0.7kg concentrate daily. Consequently, the high feed-value silage reduced concentrate requirement by 0.5kg/day to maintain the same level of performance as achieved from the medium feed-value silage.

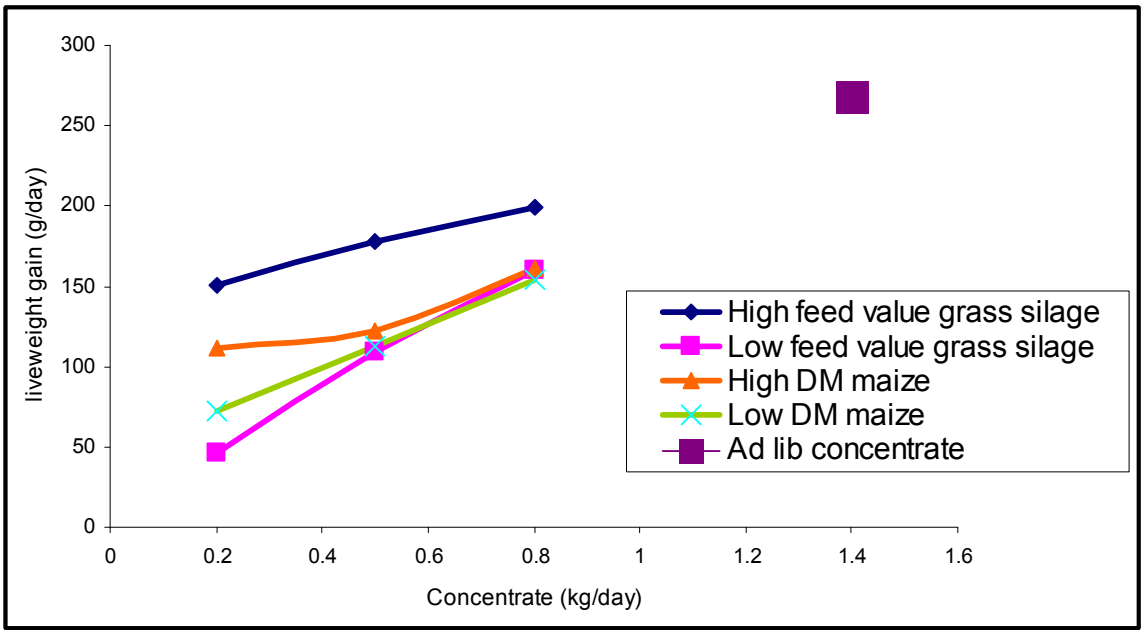
Table 1: Effect of silage type and concentrate level on lamb performance and margin over feed (MOF)

Treatment		Carcass gain (g/d)	MOF (c/day) when carcass price is		Sensitivity analysis (c/day)	
Silage	Concentrate (kg/d)		€4.00/kg	€4.50/kg	± €30/t concentrate	± 30c/kg carcass
75 DMD	0.2	74	14	19	2.2	0.6
	0.5	85	13	18	2.6	1.5
	0.8	114	19	26	3.4	2.4
70 DMD	0.2	14	-5	-3	0.4	0.6
	0.5	62	8	12	1.9	1.5
	0.8	86	11	16	2.6	2.4
High DM maize	0.2	54	8	13	1.6	0.6
	0.5	67	9	14	2.0	1.5
	0.8	90	12	17	2.7	2.4
Low DM maize	0.2	30	-2	1	0.9	0.6
	0.5	62	5	9	1.9	1.5
	0.8	86	9	14	2.6	2.4
Concentrate	*Ad-lib*	157	25	33	4.7	4.3

(Keady and Hanrahan 2011)

Effects of Maize Silage on Lamb Performance

Previous studies have shown that the optimum stage of maturity to harvest maize silage which is to be offered to pregnant ewes, lactating dairy cows or finishing beef cattle is at approximately 30% dry matter and 30% starch. The effects of maize silage, when offered as the sole forage, on lamb performance is presented in Figure 1 and Table 1. Increasing maturity of the maize silage at harvest increased lamb performance. Whilst there were no effects of maturity of maize at harvest on silage intake, the higher levels of lamb performance from the high dry matter maize silage relative to the low dry matter maize silage was attributed to the higher energy concentration of the high dry matter maize silage (reflecting the higher starch concentration). High dry matter maize silage increased lamb performance relative to medium feed-value grass silage. Low dry matter maize silage resulted in the same level of lamb performance as the medium feed-value grass silage.



(Keady and Hanrahan 2011)

Figure 1. Effect of silage type and concentrate level on lamb live weight gain (g/day)

Ad lib Concentrate Feeding

One of the treatments evaluated in the current study was concentrate offered *ad libitum*. The level of concentrate offered was increased daily and *ad libitum* intake was achieved within 10 days post housing. In the current study, the lambs offered the *ad libitum* concentrate diets received 0.5kg fresh weight of the high feed-value silage as a fibre source. Offering the concentrate *ad libitum* resulted in high levels of lamb performance (267g live weight gain daily) which is similar to the target for pre-weaning gain of twin and triplet reared lambs on grass-only systems. In the current study the lambs on

ad libitum concentrate consumed 1.4kg concentrate daily. The food conversion ratio was 9.1kg dry matter intake per 1kg of carcass gain.

Effect of Diet on Margin over Feed

The effects of diet type on margin over feed (MOF) is presented in Table 1. In the financial analysis a land charge was included for the production of the grass and maize silages. It is assumed that concentrate was purchased at €250/t. The margin over feed is presented as cent per lamb per day. The data presented in Table 1 clearly illustrate that medium feed-value grass silage (70% DMD) and low dry matter maize silage do not have a role in finishing store lambs. Offering concentrate *ad lib* resulted in the higher margin over feed at a carcass price of €4.50/kg. If lamb carcass price was as low as €4/kg, as occurred in previous years during the December to March period, *ad lib* concentrate feeding would result in the higher margin over feed even if concentrate cost €250 per tonne. This is due to the high level of performance (live weight gain of 267g/d) and the better feed conversion efficiency.

The effects of changing carcass price by 30c/kg or concentrate price by €30/t on daily margin over feed is also presented in Table 1. As concentrate price increases the advantage of offering concentrate *ad libitum* diminishes. At a lamb carcass price of €4.50/kg concentrate price would need to reach €370/t before use of any of the silages resulted in similar daily margin over feed. However, in previous years the price received for lamb carcass was lower. Consequently, at a concentrate cost of €250/t lamb carcass price would need to be less than €3/kg before offering concentrate *ad libitum* would be uneconomical relative to the use of ensiled forages.

Summary

1. Whilst finishers have little influence on lamb carcass price they can control the performance of the lambs during the finishing period.
2. Using current concentrate and lamb carcass prices, *ad libitum* concentrate feeding resulted in the greatest daily margin over feed.
3. High levels of lamb performance were achieved from high feed-value grass silage supplemented with only 0.2kg concentrate.
4. Relative to the medium feed-value grass silage, to maintain lamb daily carcass gain, the level of concentrate offered with the high feed-value grass, high dry matter maize and low dry matter maize silages could be reduced by 0.5, 0.3 and 0.1kg daily, respectively.
5. Regardless of silage type, increasing daily concentrate feed level from 0.5 to 0.8 kg/lamb during the 76 day feeding period increased carcass weight by 1.9kg, carcass value by €8.55, concentrate intake by 23 kg and concentrate cost by €5.75, respectively.

6. It is important to draft lambs regularly to avoid penalties for overweight carcasses.

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Maintaining a Disease Free Flock with Bought-in Sheep.

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The introduction of new sheep on to the farm is the greatest disease threat to an existing flock. Any movement of stock on to the farm such as sheep been brought back from a sale or show can pose a threat for the disease status of the flock. All sheep brought on to the farm are potential disease carriers, even a single well groomed pedigree ram direct from farm or a pedigree sale. Every sheep farm is different in terms of management, disease status and the immune status of the flock and an action plan needs to be in place for the treatment and management of bought-in sheep to minimize the risk of introducing new diseases into the existing flock. Furthermore, it is also possible to introduce drug-resistant parasites with the transfer of new sheep into a flock. The objective of this article is to set out "best practice" in relation to the maintenance of a high health status sheep flock and to minimise the risk of introducing diseases with the importation of animals.

There is increased risk of bringing in disease with bought in stock

Recommendations

- All bought in or returning sheep should be isolated from the rest of the flock and kept in quarantine for at least three weeks to allow for preventative treatments to be administered and regular inspections for signs of disease**.**
- Vaccination and other preventative treatments should be administered to bought-in animals for diseases that cannot be completely eradicated e.g. clostridia diseases or diseases that are currently a problem in the existing flock.
- Replacements, ideally, should be purchased from the one source each year.
- Sheep should be purchased from known sources and information sought from the flock owner on treatments given such as vaccination programmes etc.
- Animals that pose the least disease risk should be purchased; young replacement female stock and rams are generally less of a disease risk than older sheep.

All bought-in or returning sheep should be isolated from the rest of the flock and kept in quarantine for at least 3 weeks to allow for preventative treatments and vaccinations be administered and regular inspections for signs of disease

Treatments for Newly-Purchased Sheep

Footrot

Examine sheep before purchase and avoid bringing in lame animals.

Footbath sheep immediately on arrival in a solution containing 3% formalin or 10% zinc sulphate or copper sulphate. During the three-week quarantine period inspect sheep weekly for signs of lameness and examine the feet for other lame causing diseases such as Contagious Ovine Digital Dermatitis (CODD).

If sheep are still lame after the three-week quarantine period, these sheep should be kept separate from the main flock and animals not responding to treatment culled.

Scab and Lice

Scab is a highly contagious disease and is often brought onto the farm with sheep coming from marts or sales. Dipping should be carried out soon after sheep arrive on the farm and while sheep are in the quarantine area.

Plunge dipping is the most effective treatment for the eradication of both lice and scab. For effective treatment ensure the dip solution is mixed at the recommended rate and the solution replenished as

recommended. Sheep should be kept in the bath for one minute and the head completely immersed in the solution twice.

A number of injectable products are also effective in the control of sheep scab. Some of these products require a second treatment seven days after the first treatment - always follow the instructions. Lice can be controlled with pour-on products such as Vector, Spoton etc that are licensed for use on sheep for the control of sucking and biting lice.

Anthelmintic – Resistant Worms

The following protocol should be followed to prevent the risk of introducing anthelmintic resistant parasites on to the farm with bought-in replacements.

- Dose with Avermectin (Group 3, 'clear' drenches) and Levamisole (Group1 'yellow' drenches) based products on arrival to the farm. Moxidectin is the preferred choice in the avermectin group given that there are reported cases of resistance to ivermectin products in the UK. The two doses should be given as separate doses but can be given immediately after each other in the one operation.
- Zolvix (Monepantel) is a new anthelmintic recently launched on to the market. It is in a new drug class and is recommended for use only as a quarantine drug for bought-in sheep.
- Sheep should be held off pasture for at least 24 and preferably 48 hours until any worm eggs present in the gut have passed out in the faeces. After 24 hours, about 90% of eggs will have passed out and 99% will have passed out by 48hrs.
- Turn out to 'dirty' pasture, ground previously grazed by sheep.

Liver Fluke

If no information on the previous history of the grazing conditions and fluke treatments is available, then bought in sheep should be sequentially dosed with flukicide products containing tricabendazole and closantel.

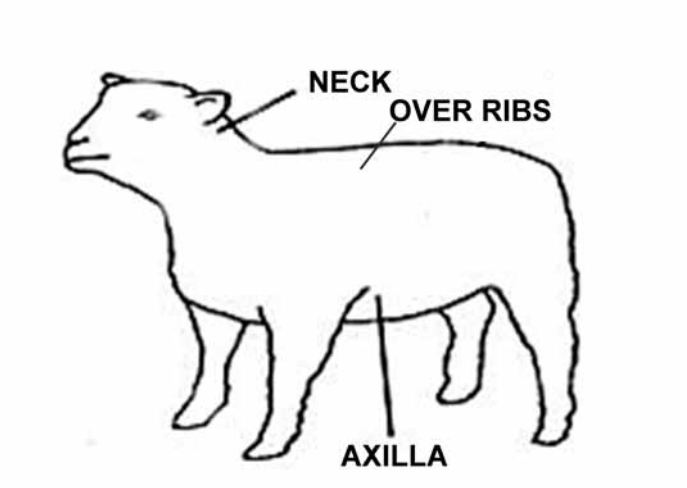
Enzootic Abortion

Where sheep are coming from an unknown or a number of sources, vaccinating with the vaccine Enzovac will help to reduce the risk of introducing enzootic abortion into the flock. The vaccine should be given at least four weeks before mating. Where animals are not vaccinated, bought-in sheep in their first lambing season should be lambed separately from the main flock.

Toxoplasmosis

Toxoplasmosis is not directly transmitted between sheep. However, there is a risk that bought-in female replacements may not have developed immunity to the disease and this could result in high levels of barrenness or abortion in the first lambing season. The Toxovac vaccine is effective in

protecting susceptible animals from an outbreak of the disease and should be considered for treating young bought in female replacements. The vaccine should be given at least four weeks before mating.



For subcutaneous injections, use a sharp 1 to 1.5cm length and 16- or 18-gauge diameter needle. One good site for subcutaneous vaccinations is over the ribs. Another is the axilla, behind the armpit. A third is high up on the neck, a site that is easy to reach and is unlikely to result in lameness and muscle (carcass) damage. Needles should be switched after every 20 - 30 sheep to minimise infection and the risk of disease transfer.

Clostridial Diseases

Where the vaccination programme on the previous farm cannot be confirmed, bought-in sheep should be treated as if they haven't been on a clostridial vaccination programme, and be given a primary course of two vaccinations 4-6 weeks a part.

Controlling Lameness in Sheep

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Lameness and controlling it is a major cost in terms of time and money expended on products to treat/prevent the condition as well as associated production losses. Apart from the cost lameness is also seen as an animal welfare issue and it has a significantly negative impact on animal performance.

There are many different reasons why sheep may become lame. Therefore, proper identification of the cause of lameness is required for treatment to succeed. Work carried out on the Teagasc BETTER farms has shown that there is a huge variation in the level of lameness / misshaped hooves and also a large variation in the causes of lameness between farms.

Common Causes of Lameness

Under Irish conditions the following are the most common causes of lameness in sheep:

1) Sores between the digits at the back of the foot, no smell from the sore and sheep become severely lame very quickly. This is most likely to be scald.
2) Hoof horn lifting, foul smell, rotting in hoof. This is most likely to be footrot.
3) Infection breaking out between the coronary band and the hoof. (i.e. where the hoof meets the hair on the leg. This is characterised by severe lameness and no smell. This is likely to be Contagious Ovine Digital Dermatitis (CODD)– seek Veterinary advice
4) Injuries and infections in the joints etc are generally characterised by swelling, heat and tenderness in the affected area.

Once the cause of lameness has been identified, a treatment/prevention programme must be put in place. The aim should be to keep the number of lame sheep at any one time below 5%. For infections caused by footrot and scald an appropriate footbath solution will control mild cases and prevent infection. Severe cases may need hoof paring and antibiotic treatment. Table 1 outlines the various footbath solutions that can be used to control these infections.

Table 1: Potential products for the control and prevention of lameness in sheep

Chemical	Concentration	Advantages	Disadvantages
Formalin	3% of 40% formaldehyde. (i.e. 300ml per 10 litres of water Avoid higher concentrations due to risk of skin damage	• Sheep can walk through – fast working • Cheap • Breaks down naturally and is easily disposed	• Cannot be reused after one day • Stops working if contaminated with mud, straw, faeces / organic matter • Unpleasant – irritant, toxic and carcinogenic • Very painful for lame sheep • Hoofs become hard / brittle with repeated use
Zinc Sulphate	10% (1kg per 10 litres) using Zinc Hexahydrate. 6.5% (650g per 10 litres) using Zinc Monohydrate Add a few squirts of washing up liquid to improve horn penetration	• Can be reused • Not painful • Not deactivated by organic matter	• Can be toxic if drunk • Can be reused • Can be difficult to dissolve • Need to stand sheep in bath • Harder to dispose off – heavy metal
Copper Sulphate	10% (1kg per 10 litres	• Can be reused • Quicker to penetrate the hoof than zinc	• Expensive • Can be reused • No longer recommended by SAC due to risk of copper poisoning • Reacts with galvanised metal • Colours fleece • Toxic if drunk • Difficult to dispose off
Other **Organic acid zinc / copper salt mixtures**	Use as directed	• Quick to penetrate • Some stick to feet further improving penetration	• Expensive • Cannot be reused • Reduced efficacy if soiled with organic matter
Footvax Vaccine for the prevention of Footrot	Primary Course :1ml subcutaneous injection followed by a second 1ml dose six weeks later Booster Course; 1ml booster every 6 months	• Onset of immunity 3 weeks after primary vaccination course.	• Very expensive • Only controls Footrot
Antibiotic footbaths	Use as directed by Veterinary Surgeon	• Useful against CODD	• Very Expensive • Can not be reused • Reduced efficacy if soiled with organic matter

Note: Table adapted from Heather Stevenson, SAC Veterinary Services, SAC Sheep & Beef Notes

An untrimmed hoof: a predisposing factor to footrot and lameness

Footrot in sheep

A sheep turn-over crate, installed as part of a race, is extremely useful to thoroughly examine sheep's feet and carry out any necessary trimming

Neatly trimmed hoofs, no evidence of bleeding or damage to soft tissue

Footbathing

For footbathing to work an effective footbathing facility needs to be in place. Treatment of scald works well in walk through baths where the sheep are slowly walked through a race which contains a footbath with an appropriate solution to a dept of 5cm. The footbath should be at least 6m long and ideally the sheep should walk through a water bath prior to entering the footbath so that their hooves are cleaned.

Sheep should be slowly walked through a race which contains a footbath with an appropriate solution (Table 1) to a depth of 5cm

Where footrot is a problem longer contact times between the feet and the footbath solution will be required. In this situation a stand-in footbath is ideal. This is a big bath that can hold 10 – 20 ewes at a time. By standing the sheep in the solution the active ingredient in the solution has a longer time to penetrate the hoof and kill any infective bacteria. Ideally the footbath should be roofed to prevent the solution from being diluted with rainwater over time. Achieving the appropriate strength of the footbath solution is an important factor in putting an appropriate control measure in place. The size of the footbath may be established by multiplying the length by width and the depth of the solution in metres. This will give you the volume of water that the bath holds in cubic metres. One cubic metre is 1000 litres.

Post Foot-bathing

Post foot-bathing it is recommended to stand sheep on a dry clean concrete surface for half an hour or so. This will allow the chemical solution to dry onto the hoofs and give prolonged protection. By allowing the sheep out of the footbath in small numbers, lame sheep or sheep with overgrown hooves can be easily identified. These sheep can then be turned and have any excess or dead hoof horn removed. It is important not to over pare feet and avoid drawing blood.

The key to managing lameness such as footrot, scald and CODD is early intervention. Frequent foot bathing coupled with prompt treatment of infected sheep will prevent infection spreading between animals. Appropriate quarantine procedures for bought in sheep are essential to prevent new infectious disease such as CODD and footrot from entering flocks that have eradicated/controlled these diseases.

Internal Parasites: An On-going Problem on Sheep Farms

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Internal parasites cause major production and economic losses in sheep flocks. Gastro intestinal worms have been shown to reduce lamb growth rate by up to 40%. In spring and early summer, the main internal parasites of concern are roundworms and coccidia. There are 2 main categories of roundworm that infect lambs:

Nematodirus

Nematodirus *(Nematodirus battus)* completes its life-cycle in one year. April and May tend to be the greatest risk period. Lambs pick up infection from grass. Therefore, lambs over five-weeks-old during April and May are most at risk. Twins are likely to be eating significant amounts of grass from a younger age than singles and therefore are at greater risk and also at risk from a younger age. Lambs tend to develop resistance to Nematodirus from about ten to twelve weeks of age onwards.

Peak nematodirus hatch usually occurs during the late April early May period. Benzimadazole (white drench) or Levamisole (yellow drench) are the drugs of choice, for the control of nematodirus

A lamb with clinical signs of severe nematodirus infection

Roundworms

Teladorsagia (formerly known as *Ostertagia*) and *Trichostrongylus* species complete their life-cycle in much shorter periods of time. They tend to affect older lambs – ten weeks and older. Therefore, they tend to become a problem from late May/early June onwards.

Coccidiosis

Coccidiosis, which is caused by a coccidia called *Eimeria*, can cause problems in April/May in young lambs (3-8 weeks old). Clinical symptoms are most apparent from 6 – 8 weeks of age. This is coincidental to the time of the main threat of Nematodirus. Lambs are protected by antibodies in the colostrum for the first three weeks of life and they develop resistance to attack from about eight weeks of age. The information presented in Table 1 outlines the main internal parasites, when they are most likely to cause problems, clinical symptoms and prevention/control measures recommended.

Wormer Groups

There are many different wormer products available on the market. However, all products fit into one of four classes. These are as follows:

1. Benzimadazole (white wormer);
2. Levamisole (yellow wormer);
3. Macrocyclic Lactones (Avermectins, also known as clear wormers); and ,
4. Monepental (orange wormer).

The fourth wormer group, with the active ingredient of Monepental was released onto the Irish market in 2010. This was the first new group of anthelmentics developed and released in over twenty-five years. It is only available through veterinary prescription. A fifth group, Spirandoles is not yet available on the Irish market but is expected to be released in 2012.

Anthelmintic Resistance

The biggest problem facing roundworm control in sheep has been the development of resistance to anthelmintics among worm populations in many sheep flocks. Resistance means that the worms are resistant to the dose and are not killed by it. To-date it has not been an issue with nematodirus but is a significant problem with *Teladorsagia and Trichostrongylus* species. Studies have shown a major problem exists with Benzimadazole (white drench) and Levamisole (yellow drench). While unconfirmed yet in Ireland, resistance may also become a problem with Macrocyclic Lactones (Avermectins). Hopefully, the efficacy of the newer groups can be preserved for as long as possible. The only sure way of knowing if resistance is a problem on your farm, is to have faecal egg counts done pre and post dosing to check the efficacy of the treatment used. This test is a simple procedure

involving taking fresh dung samples and having them analysed in a laboratory. It can be arranged through your veterinary surgeon. For further information on anthelmintic resistance and how to deal with it see paper by B. Good in this publication.

In the case of the other roundworms a strict management approach is required and dosing should be based on results of faecal egg counts

Dosing Guidelines

When dosing for worms, farmers should be cognisant of the principles of sustainable control of intestinal parasites. In the case of nematodirus, only anthelmintics effective against adult worms should be used with Benzimadazole (white drench) or Levamisole (yellow drench) being the drugs of choice. In the case of the other roundworms *(Teladorsagia* & *Trichostrongylus*) a strict management approach is required and dosing should be based on results of faecal egg counts. Dosing should only take place when justified. Dosing should also be delivered effectively, in particular:

- Avoid under-dosing by;
- Dose according to the heaviest lamb in the group (not the average);
- If there is a large weight variation, split flock into two groups to avoid overdosing. Then dose each group according to the heaviest lamb in that group; and ,
- Ensure the dosing gun is calibrated to deliver the correct dose.

Clean Pasture

Ideally, the primary aim should be to have clean or safe pastures as much as possible (i.e. pastures with low parasite challenge). If an adequate amount of this pasture was available, the requirement for dosing would be significantly reduced. However, for lambs grazing in summer, a clean pasture is one that has not been grazed by sheep since the previous autumn. Therefore, it is rare that a sheep farmer will have "truly" clean pasture. The nearest to this is silage /hay aftermath not grazed by sheep in the current year. Even this is not common as most

Table 1: Internal parasites of mid season lamb

Parasite	**Coccidia**	**Roundworms**	
Species	***Eimeria***	***Nematodirus battus***	***Teladorsagia (Ostertagia)/ Trichostrongylus* species**
Time of Problem	• Lambs 3-8 weeks • Young lambs grazed after older lambs • Lambs coming together e.g. for creep feeding	• Lambs 5-10 weeks • April/May • Triggered by cold weather followed by warm spell (Synchronised hatch of eggs)	• Lambs > 10 weeks old • June onwards (Teladorsagia) • Late summer / autumn (Trichostrongylus)
Symptoms	• Acute Diarrhoea • Blood in scour (maybe) • Poor thrift • Loss of appetite • Scouring still apparent after dosing for *Nematodirus*	• Diarrhoea • Wasting • Dehydration • Mortality • Lambs congregating around kers while ewes continue to graze	• Diarrhoea • Weight loss • Dehydration
Prevention /Control	• Hygiene • Avoid overcrowding • Adequate colostrum of newborn lamb • Move feeders or drinkers regularly • Keep feeders drinkers at a raised level to avoid faecal contamination • Feed additive e.g. Deccox or dose e.g. Vecoxan. If possible move treated lambs to 'clean' area	• Clean Pasture not grazed by sheep/calves the previous year • Dose with white wormer or Levamisole at 5 weeks (+) i.e. late April/May (Dept. of Ag. Issues warnings)	• Clean pasture (hay / silage after-grass) • Combination of pasture management and planned dosing programme • Dosing based on faecal egg counts • Test for anthelmintic resistance

farmers graze their silage ground before closing for silage. In the past, the general recommendation was to dose and move to 'clean' pasture'. However, even if you have clean pasture, it is now believed that dosing followed by a direct move to 'clean' pasture is highly selective for resistance. Worms that survive treatment (hence resistant) will contribute significantly to the population that subsequently arises on the 'clean' pasture. Consequently, various alternatives to this direct 'dose and move' approach have been suggested. These alternatives include:

- Delay the move for 4-7 days after dosing;
- Move to clean pasture for a few days before dosing; and
- Some of the lambs (10%) may not be dosed at all.

The reason for these measures is to ensure that some of the worms that survive on the farm are susceptible and therefore maintain the efficacy of the dose.

Protocol for Dealing with Purchased Sheep

When introducing sheep onto your farm from an outside source special care is essential. It is best practice to assume that all sheep being introduced are probable carriers of gastrointestinal parasites that are resistant to anthelmintics. Therefore, all bought in sheep should be treated accordingly. The following is the recommended practice:

- The number one choice is a drench with a monepantel (4-AD) product followed immediately by moxidectin. The dual dose is used to increase the chance of killing all resistant worms being carried by the purchased animals. (A less effective alternative is to use a levamisole product followed by a macrocyclic lactone).
- To prevent shedding of anthelmintic-resistant larvae on pasture in the days after dosing, hold treated sheep inside or on concrete for up to 48 hours.
- Turn out on to pasture that has carried sheep in that season and keep isolated from other sheep in the flock for at least three weeks.
- Check for anthelmintic resistance by monitoring faecal egg counts after dosing (14-16 days after macrocyclic lactones, seven days after levamisole).

Withdrawal Dates

Finally, the importance of adhering to withdrawal dates must be stressed. Particular attention is needed with lambs approaching slaughter weights. If there is a possibility that they will be slaughtered before the expiry of the drug withdrawal period the dose should not be given or an alternative product could be used.

Summary

Internal parasites are of major concern for Irish sheep farmers. There is a heavy reliance on the use of anthelmintics to control these worms. The problem of anthelmintic resistance is now a significant challenge facing roundworm control in sheep flocks. To preserve the effectiveness of wormers being used a strategic approach is required. This should involve only dosing when necessary and based on faecal egg counts. It should also involve following the guidelines outlined above. Furthermore, whenever possible, better use should be made of clean, pastures with low worm burdens.

Anthelmintic Resistance – A Potential Challenge for Sheep Producers?

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Parasitic gastroenteritis, caused by roundworms (nematodes), is well recognised as a major production-limiting disease, particularly in lambs. Effective parasite control has become heavily dependent on anthelmintics. The development of anthelmintic resistance by roundworms poses a potential crisis for sheep producers and measures to avert and delay this are essential. This report summarises the main results from studies at Teagasc, Athenry, examining the anthelmintic resistance status of Irish lowland commercial flocks and recommendations to combat the challenges facing producers in controlling parasites are outlined.

Gastrointestinal Parasites

The main roundworms that affect lambs are *Nematodirus battus* in the spring, while later on in the season, a number of other roundworms feature, among which *Teladorsagia* (formerly known as *Ostertagia*) and *Trichostrongylus* species (black scour worm) are the most important. In general, the life cycle of all these gastrointestinal parasites (with the exception of *Nematodirus battus*) is similar. Adult worms in the sheep's gastrointestinal (GI) tract mate and the females lay eggs, which pass out in the sheep's faeces. The egg develops in the faeces and hatches to release a feeding larva (L1 stage). This L1 subsequently undergoes further development to the L2 stage and then to the non-feeding infective stage (L3), which subsequently migrates on herbage awaiting ingestion by a suitable host. Once ingested, the L3s will complete their development to adults (at their preferred sites along the G1 tract) within 15 to 21 days, for most common roundworm species. The life cycle of *Nematodirus battus* is slightly different in that development to L3 occurs entirely within the egg and hatching occurs in response to a cold stimulus the following spring. Thus *N. battus* is a parasite that can largely be avoided if lambs are not grazed on the same pasture each spring.

Anthelmintics

While there are many anthelmintic products on the market that are highly effective against a broad spectrum of roundworm species, they can be grouped based on their mode of action into four classes of compound:

1. **(BZ)** -Benzimidazoles and probenzimidazoles (e.g. albendazole, fenbendazole, oxfendazole, mebendazole) – oral formulation;
2. **(LM)** -Levamisole - oral formulation;
3. (ML) - Macrolcyclic lactones (including abamectin, doramectin, ivermectin, and Moxidectin) –oral injectable formulations; and ,
4. **(AD) -** Amino acetonitril derivatives (monepantel) – oral formulation.

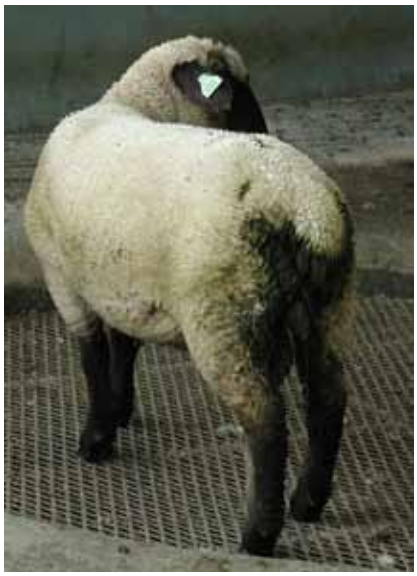
Anthelmintic Resistance

There is no doubt that the advent of broad-spectrum drugs has played a crucial role in diminishing the effects of parasitism in grazing sheep, and has supported an increase in productivity. However, parasites are developing resistance to these anthelmintics, which is allowing worms to survive exposure to the standard therapeutic dose of the anthelmintic, survive and produce offspring. So over time, with increased anthelmintic use the development of anthelmintic resistance is inevitable as resistant worms become more prevalent in Irish sheep flocks. Clinical evidence (persistent diarrhoea, lack of thrive) for failed treatment then becomes apparent. Resistance can occur within anthelmintic classes and to more than one class of anthelmintic.

With little immunity, lambs in their first grazing season are vulnerable to infective larvae on pasture. An integrated approach to worm control in lambs is required to protect the efficacy of anthelmintics

Methods to Detect Anthelmintic Resistance

The most widespread methods used to detect anthelmintic resistance are the drench test, faecal egg count reduction test, egg hatch assay and larval development test. The drench test involves determining the faecal egg count at a suitable interval (time depends on the class of anthelmintic) post anthelmintic treatment. The faecal egg count reduction test involves calculating the mean reduction in faecal egg count at a defined interval post treatment (which is dependent on the anthelmintic being tested) for a sub-group of the flock (minimum of 12-15 sheep faecal sampled pre and post treatment). While these are suitable for testing all anthelmintic groups, they lack sensitivity and are only reliable if more than 25% of the worms are resistant. The egg hatch and larval development assays involves examining the development of these stages from eggs obtained from pooled fresh faecal samples (from a sub-group of the flock) in various concentrations of the anthelmintic. The larval development test can be used to detect resistance to both benzimidazole and levamisole. Anthelmintic resistance testing is available via your Veterinary Practitioner at the Regional Veterinary laboratories and at some veterinary practices or private laboratories.



Lamb with typical signs of parasitic gastroenteritis

Evidence for Anthelmintic Resistance

The evidence for nematode resistance to benzimidazoles worldwide is compelling. Results from studies in Irish flocks reveal an alarming incidence of anthelmintic resistance to two of the anthelmintic classes currently available on the market (Good *et al*., 2003; Good *et al*., 2006; Patten *et al*., 2007, Good *et al.,* 2011). Using the faecal egg count reduction test on 16 farms involved in collaborative projects with Teagasc, resistance to benzimidazole was evident in 94% and to levamisole in 38% of flocks. Similar results were also observed in a nationwide survey of 64 representative Irish farms using the larval development test. Anthelmintic resistance was observed in *Teladorsagia,*

Trichostrongylus and *Cooperia* species. As yet, there is no evidence for anthelmintic resistance in *Nematodirus battus.* The evidence above clearly shows that Irish flock owners need to realise that the development of anthelmintic resistance is in progress on many of their farms.

Measures to Delay Anthelmintic Resistance

The development of anthelmintic resistance poses a potential crisis for sheep producers and measures to avert / delay this are now essential. In 2009, (after a gap of 25 years), the launch by Novartis of a new class of anthelmintic (AD, monepantel) to the Irish market was a most welcome development. More recently, a novel combination drench with a new active, derquantel, has been launched in New Zealand by Pfizer Animal Health. These developments present both an opportunity and challenge to become more effective at delaying the development of resistance. Measures by sheep producers to delay anthelmintic resistance and prolong the lifespan of anthelmintics are now essential.

The essential actions required to slow the progression of anthelmintic resistance are:

- the effective (proper) administration of anthelmintics;
- only use anthelmintics when necessary;
- use the most appropriate anthelmintic;
- reduce dependence on anthelmintics;
- avoid the introduction of resistance onto a farm by treating purchased stock on arrival (either macrocyclic lactone / monepantel) followed by a quarantine period;
- maintain anthelmintic susceptible population of worms; and ,
- test for anthelmintic resistance (regularly).

Essentially, if the underlying principles of delaying resistance namely (a) best anthelmintic practice and (b) strategies that reduce the selection pressure for resistance are adhered to, the emergence of anthelmintic resistance will be minimised.

The Future for Anthelmintics

Fundamental to sustainable parasite control is a reduction in the reliance on anthelmintics with more effort directed in managing parasites than just the 'treat and forget' approach of the past. The future for anthelmintics in the control of gastrointestinal infections lies in our increased understanding of how anthelmintic resistance develops and research in to the development of more sensitive methods for detecting resistance in order to monitor and provide the capacity to develop case specific action programmes that prolong the lifespan of anthelmintics. Meanwhile the adoption of best anthelmintic practices to preserve the effectiveness of anthelmintics in controlling the impact of parasites on animal performance is crucial.

Liver Fluke Disease

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Is liver fluke costing you money? You don't get paid for damaged livers. You have the added cost of mortality and poor thrive. Fertility of ewes can be affected as well as milk yield. This all leads to reduced output and less income. It also renders sheep more susceptible to other diseases as well as having costs associated with treatment.

Weather and Life Cycle

Liver fluke is caused by a flat leaf-like worm called *Fasciola hepatica*. An intermediate host, the mud-snail *(Lymnaea truncatula)* is also involved. The risk of liver fluke disease is closely linked with summer rainfall. High rainfall throughout the year and mild winters provide the optimum environment for the mud snail. Details of the life cycle are described in Figure 1.

These wet areas provide an ideal habitat for the mud-snail, the intermediate host of liver fluke

Left: Mud snails *(Lymnaea truncatula)*
Right: Adult mature Fluke

Identification of Problem

Acute fluke occurs as a result of large numbers of immature flukes burrowing through the sheep's liver and can lead to rapid death.

Chronic fluke arises due to more long-term exposure to infective larvae. The fluke develop in the liver and bile ducts and cause damage to the liver as well as feeding on blood. Clinical signs of chronic fluke include anaemia and loss of condition. Paleness around the eyes and the gums may indicate anaemia associated with liver fluke. There may be abdominal pain and swelling such as 'bottle jaw' due to retained fluids. Faecal egg counts can be used as an objective test for fluke. Fluke eggs in the faeces indicate the presence of mature adult fluke. However, as fluke egg counts tend to be low, they are less reliable than in the case of stomach worms as a measure of the burden of fluke. They are only useful as an indication of chronic and are not useful as a test for acute fluke. The examination of the livers of slaughtered animals is a good check for liver fluke. Any unexplained death should be investigated by means of post mortem. Fresh carcasses can be referred to the nearest veterinary laboratory. This must be arranged through the flock veterinary surgeon.

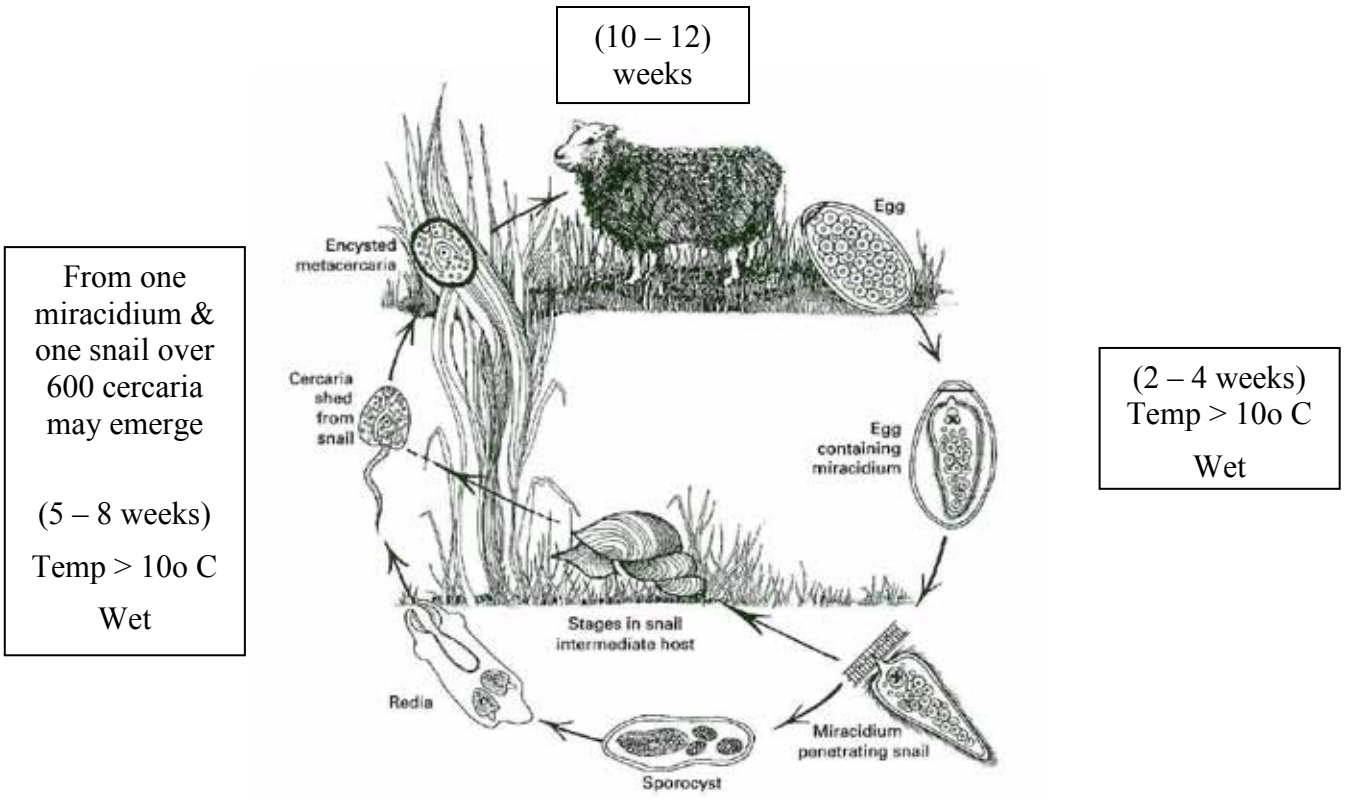

Figure 1. Liver Fluke life cycle – (From Mike Taylor, (2009), CPD Seminar on Liver Fluke

Treatment of the problem really needs to be farm specific. Flukicides can be divided into a number of

groups according to active ingredient, as outlined in Table 1. Examples of products under each group are presented in Table 2. Triclabendazole is the only group that has activity against early immature fluke. However there have been cases of resistance to these products. Closantel, Nitroxynil, and Rafoxanide are also active against immature fluke over 6 weeks old. Products containing Oxyclozanide and Albendazole (given at 1.5 times the worm dose) are only active against adult fluke. When animals are to be slaughtered it is critical to be aware of withdrawal periods.

The choice of product should be based on the type of infection, in particular the stage of development of the fluke. If diagnosis indicates a large presence of immature fluke you need to treat with a product effective against immature stages. In this instance, it may be appropriate to opt for a Triclabendazole product. This may well be the case for ewes that have been out-wintered and have been grazing pastures contaminated with encysted metacercariae. On the other hand, if sheep have not had access to this type of pasture for the past 8 to 10 weeks and yet are showing signs of the disease, they will not have immature fluke. This may be the case with ewes that were housed two months earlier. They may be infected with adult fluke if they have not been adequately treated or not dosed at all. They may now benefit from a dose effective against adult fluke. The best advice is to consult your veterinary surgeon to draw up a treatment programme appropriate to your farm.

Table 1: Efficacy of drugs at recommended dose rate against *Fasciola hepatica* in sheep

<table>
<tr><th rowspan="2">Flukicide (Active ingredient)</th><th colspan="14">Liver fluke – stage of development in weeks</th></tr>
<tr><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th><th>10</th><th>11</th><th>12</th><th>13</th><th>14</th></tr>
<tr><td>Albendazole</td><td colspan="8" rowspan="2"></td><td colspan="2" rowspan="2">50-70%</td><td colspan="3" rowspan="2">80–99 %</td></tr>
<tr><td>Oxyclozanide</td></tr>
<tr><td>Nitroxynil</td><td colspan="6"></td><td colspan="2">50–90 %</td><td colspan="5">91-99 %</td></tr>
<tr><td>Rafoxanide</td><td colspan="6"></td><td colspan="2">50–90 %</td><td colspan="5">91-99 %</td></tr>
<tr><td>Closantel</td><td></td><td colspan="2">23-73 %</td><td>91</td><td colspan="4">91–95 %</td><td colspan="5">97-100 %</td></tr>
<tr><td>Triclabendazole</td><td colspan="2">90-99 %</td><td colspan="12">99–99.9%</td></tr>
</table>

Adapted from presentation by B. Good, Teagasc, Athenry, October 2009

Protocol for Dealing with Purchased Sheep

- On arrival at the farm all animals should be quarantined/isolated for period at least three weeks.
- Fencing should be adequate to ensure containment of the isolated sheep.
- All added sheep should be treated on arrival and again in 6-8 weeks with a flukicide effective against immature and mature fluke.

Withdrawal Dates

The importance of adhering to withdrawal dates must be stressed. Particular attention is needed with lambs approaching slaughter weights. If there is a possibility that the animal will be slaughtered before the expiry of the drug withdrawal period the dose should not be given or an alternative product could be used.

Table 2: Examples of products available containing each active ingredient, with company name and withdrawal dates (other products are available)

Active Ingredient	Examples of products	Company	Withdrawal time - days
Albendazole (*adult fluke)*	Albex 10% Trimazole 10% Valbazen 10%	Chanelle Animal Health Univet Pfizer	10 4 10
Oxyclosanide (*adult fluke)*	Zanil Nilzan	Intervet Schering Plough Intervet Schering Plough	28 28
Nitroxynil *(adult and immature fluke)*	Trodax 34%	Merial Animal Health	60
Rafoxanide *(adult and immature fluke from 3-4 wks)*	Ridafluke Flukex 3% Curafluke	Chanelle Univet Univet	60 60 60
Closantel *(adult and immature fluke from 3-4 wks)*	Flukiver 5% *(dose / injection)* Supaverm (Fluke and worm) Duotech (Fluke and worm)	Jansen Jansen Norbrook	42 /56 42 14
Triclabendazole *(from early immatures to adult fluke)*	Fasinex Tribex Fasifree	Novartis Chanelle Osmonds	55 56 56

Summary

Liver fluke has a complex life cycle. It causes serious loss both from an animal welfare and from an economic point of view. Treatment needs to be farm specific. You should make use of whatever information you have to identify any possible problem. Then it is important to draw up a treatment programme with veterinary advice.

Ewe Body Condition Impacts on Weaning Rate

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It has long been recognised that live weight per se is not a reliable indicator of the body reserve status of the ewe unless age and breed are known and even then can be misleading. For example, the mature weight of ewes differs substantially between breeds (Table 1). Furthermore the weight of ewes within a flock varies according to age. Therefore, if the mean ewe weight in a flock is 70kg, the weight of sheep will vary by around 10kg due to age (Table 2).

Table 1: The effect of ewe breed on average mating weight

Breed	Weight (kg)
Purebred Suffolk	85
Purebred Texel	80
Purebred Belclare	76

Hanrahan, J.P. – personnel communication

Table 2: The effect of ewe age on live weight at mating

Age at mating (years)	Weight (kg)
1.5	66
2.5	70
3.5	75

Hanrahan, J.P. – personnel communication

Condition score, which is assessed on a scale of 0-5 is frequently used as a management tool, particularly with dairy cows, for nutritional management to have animals at their optimum for lactation and for breeding. Condition score is a "hands on" method of assessing the fatness (or condition) of animals. In sheep production, the most important time in the annual cycle for the ewe to be at target condition score is at the point of mating. Condition scoring does not require any equipment, is easy to learn and overcomes differences in ewe weight due to breed, age and physiological state (e.g., pregnancy).

Impact of Condition Score on Weaning Rate

Condition of the ewe at mating impacts on subsequent litter size and weaning rate. Research undertaken on the lowland ewe flocks at Athenry and on 17 commercial lowland flocks, as part of the Technology Evaluation Transfer (TET) project, clearly illustrates that each one unit increase in condition score (within the range 2.5 to 4) at mating increases litter size by 0.13. This increase in litter size subsequently increases weaning rate by 0.1 lamb per ewe put to the ram. Mating ewes at condition score of less than 2.5 increases the risk of barrenness, consequently, further reducing weaning rate. Each 0.1 lamb/ewe increase in weaning rate is worth approximately €9/ewe put to the ram in flocks which produce mid season prime lamb fit for slaughter.

Ewe condition at mating has a direct effect on the number of lambs reared per ewe put to the ram

Effect of Ewe Weight on Condition Score

Research at Athenry clearly illustrates, that within the condition score range of 2.5 to 4.0 for many lowland breed types, that each 1 unit increase in condition score is equivalent to an increase of 12kg in live weight. Consequently, for a flock to be at the target condition score (3.5-4.0) at the point of mating it is essential to condition score the flock well in advance (i.e.at weaning) to enable any changes in condition to be achieved. In general, ewes on good grass swards have the ability to gain approximately 1kg/week. Condition scoring the flock at or shortly after weaning provides adequate time, if required, to increase condition score cost effectively through increased grass intake. At weaning ewes should be at least condition score of 2.5.

In the past prior to mating, ewes were "flushed" which is the practice of reducing condition post weaning by tight grazing, and then raising the plane of nutrition for about three weeks prior to going to the ram so that the sheep should be improving in liveweight and body condition at mating. However, if ewes are in good condition after weaning they should not be deliberately slimmed down with the intention of improving condition prior to mating. This practice would be an inefficient use of energy intake by the ewe.

Condition score is easily accessed by handling the ewe in the lion area

How to Condition Score Sheep

Body condition score is assessed by handling the ewe along the top and side of the back bone in the loin area immediately behind the last rib and above the kidneys (Figures 1 and 2) as follows:

1. Feel the degree of sharpness or roundness of the spinous processes using the finger tips;
2. Feel the tips of the transverse processes using finger pressure for sharpness or roundness; and ,
3. Press the fingers into the area between the spinous and transverse processes to determine the eye muscle and fat cover.

A Brief Description of each of the Scores are as Follows:

Score 0: It is not possible to detect any muscle or fat tissue between the skin and bone. The animal is extremely emaciated and on the point of death. Score 0 is rarely seen on Irish farms;

Score 1: The spinous and transverse processes are sharp and prominent with a distinct gap between each process (Figure 3);

Score 2: The spinous and transverse processes are prominent but smooth. It is possible to press the fingers under the transverse processes with some pressure;

Score3: The spinous processes are smooth and rounded and are detectable with a little pressure. The transverse processes are smooth and rounded and the ends are only detectable with firm pressure. The eye muscle is full with some fat. (Figure 4);.

Score 4: The spinous processes can be detected only with pressure as a hard line. The transverse processes cannot be detected. The eye muscle is full with a moderate degree of fat cover; and ,

Score 5: Neither the spinous or transverse processes can be felt, even with pressure. There is a thick cover of fat and the eye muscle is full. There is a depression along the mid-line fat where the spinous processes would normally be felt (Figure 5).

Experienced operators use half scores (i.e. 2.0, 2.5, 3.0, 3.5, etc) to enable more accurate prediction of ewe condition.

Summary

1. Ewe body condition at mating affects litter size and weaning rate.
2. Condition score is easily accessed on a score from 0-5 by handling the ewe in the loin area.
3. Each 1 unit increase in condition score increases weaning rate by 0.1lamb/ewe put to the ram which is worth approximately €9.
4. To increase condition score by 1 unit the ewe must gain 12kg live weight.

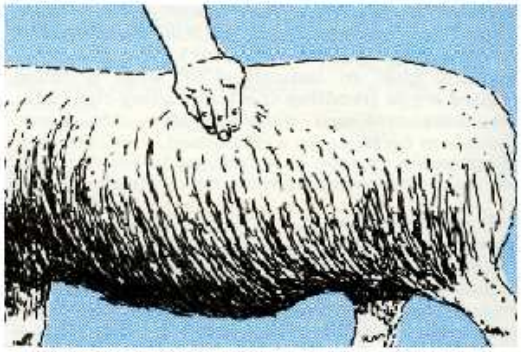

Figure 1. Condition scoring sheep in the loin area

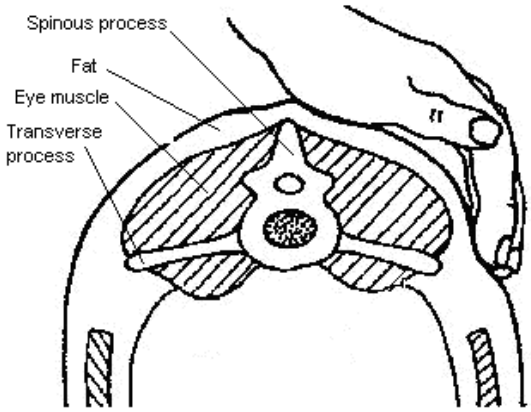

Figure 2. Feeling the tips of the spinous and transverse processes in the loin area

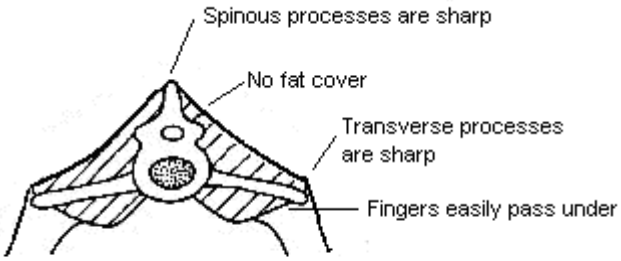

Figure 3. Condition score 1

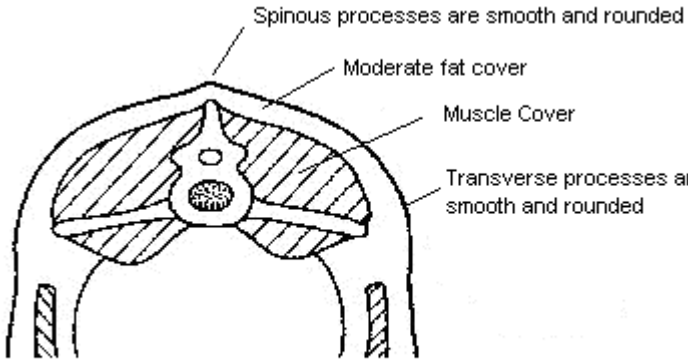

Figure 4. Condition score 3

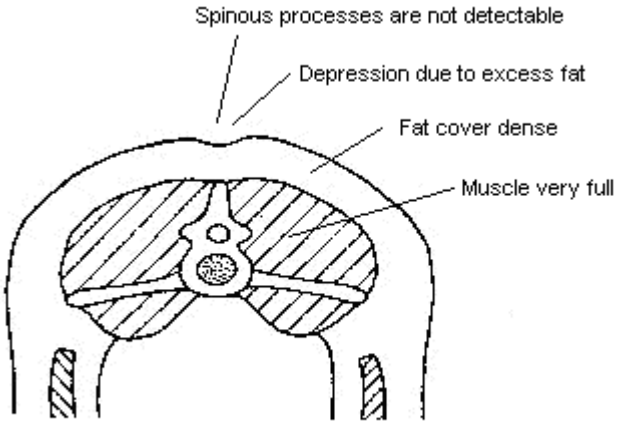

Figure 5. Condition score 5

Season of Shearing Impacts on Flock Profitability

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During the past year the margins from sheep production have increased primarily due to increased lamb carcass price. Also during this period the value of wool has nearly trebled (although from a low base price). For animal welfare reasons ewes must be shorn at least once per year. Many ewes, particularly from lowland flocks, are housed from mid December until lambing. Time of year at which sheep are shorn impacts on ewe performance and the growth rate of the subsequent offspring, and consequently, on flock profitability. The aim of this paper is to highlight, from recent studies at Athenry, how shearing at housing effects subsequent animal performance and flock profitability.

Shearing at Housing

Three studies have been undertaken at Athenry in recent years which have evaluated the effects of shearing ewes at housing on subsequent lamb performance until weaning. In each of these studies ewes were housed either unshorn, or shorn in mid-December and offered grass silage *ad libitum.* For the six weeks prior to lambing ewes carrying singles, twins and triplets each received a total of 12, 20 and 25kg concentrate, respectively. Ewes rearing singles and twins, and their lambs, were grazed as one flock post-lambing, without concentrate supplementation. Ewes rearing triplets were grazed as a separate flock and received 0.5 kg concentrate daily for five weeks post-lambing, whilst lambs reared as triplets received up to 300 g concentrate daily until weaning.

Effects on Animal Performance

The effects of shearing ewes at housing on subsequent lamb performance are presented in Table 1. Shearing ewes at housing did not affect the condition score of the ewes at lambing. However, lambs born from ewes which had been shorn at housing were 0.6 kg heavier at birth and 1.9 kg heavier at weaning and subsequently were approximately two weeks younger at slaughter. Whilst shearing at housing increased lamb birth weight, it did not effect the incidence of lambing difficulty.

Previous studies at Athenry have shown that each 1kg increase in lamb birth weight increases weaning weight by 3.2kg which is similar to the response in the present studies due to winter shearing. The increased birth weight of the lambs from the ewes which were shorn at housing was due to increased silage dry matter intake which was partly a reflection of cold stress immediately post shearing, and more importantly, a reflection of reduced heat stress in late pregnancy. Shearing at housing also increased ewe gestation length by 1.5 days.

Table 1: Effect of shearing ewes at housing on subsequent lamb performance

	Shearing date	
	May	**Mid December**
Ewe condition score at lambing	3.5	3.4
Lamb birth weight (kg)	4.1	4.7
Lamb weaning weight (kg)	31.5	33.4

Keady and Hanrahan 2008, 2009a; Keady et al. 2007

The increase in lamb weight at weaning (+1.9 kg) obtained due to shearing ewes at housing is the same response as would be expected from providing 19 kg of creep concentrate to each lamb prior to weaning, which is equivalent to a cost of approximately €6/lamb. Shearing at housing (cost €2.50/ewe) is equivalent to a saving in creep concentrate of approximately €10/ewe for ewes rearing 1.7 lambs.

Winter shearing increases lamb birth weight by 0.6 kg and reduces lamb age at slaughter by approximately 2 weeks

Effects on Fleece Weight

The value of wool has trebled in the past 15 months (although from a low base level). The effect of season of shearing on fleece weight is presented in Table 2. Shearing ewes at housing increased the weight of wool harvested by 0.3 kg/ewe relative to shearing in May.

Table 2: Effect of shearing ewes at housing on fleece weight

	Shearing date		
	May	**September**	**December**
Fleece weight (kg)	2.8	2.6	3.1

Keady and Hanrahan 2009b

Other Advantages of Shearing at Housing

Shearing ewes at housing enables more ewes to be housed in a given area. For example, if housed in straw bedded pens 70kg unshorn ewes require 1.2 m^2 floor space. However, shorn ewes require less floor space. Consequently if ewes are shorn at housing approximately 15% more ewes may be over wintered in the sheep house. Shearing during December occurs during a period of low labour demand for flock management, consequently spreads the work load. Furthermore, shearing during May or June requires the additional task of separating lambs from the ewes.

Winter shearing enables approximately 15% more ewes to be housed in a given area

Shearing at Other Times

Shearing at other times (than early summer or at housing) may enable the total flock to be assembled, without lambs at foot and during good weather conditions. Two studies were undertaken, one at Athenry and the second on a large commercial farm, to evaluate shearing either four weeks prior to mating (September) or at housing relative to shearing conventionally in early summer. All ewes at each site were kept in one flock throughout the grazing and mating seasons and were housed in mid-December and offered the same diet. The effects of time of shearing on subsequent ewe and lamb performance are presented in Table 3.

Table 3: The effects of time of shearing on lamb birth weight

	Time of Shearing		
	June	**September**	**December**
Lamb birth weight (kg)	4.3	4.6	4.8

Keady and Hanrahan 2008,2009b

The heaviest lambs were produced from ewes which were shorn at housing whilst the lightest lambs were produced from ewes shorn in June. The mean litter size and weaning rate were 2.03 lambs and 1.87 lambs per ewe put to the ram, respectively, and were not significantly influenced by the time of shearing. Furthermore, shearing the ewes prior to mating did not reduce the number of barren ewes relative to shearing at housing. Relative to shearing at housing, shearing prior to mating reduces fleece weight by 0.5kg. The results of these studies indicate that September shearing (about four weeks prior to mating) provides an alternative strategy whilst achieving approximately 50% of the benefits on lamb birth weight as shearing at housing (December).

Effect of Shearing at Housing on Flock Gross Margin

To determine the effect of season of shearing at housing on gross margin per ewe it is assumed that:

- **(a)** each ewe rears 1.7 lambs;
- **(b)** mean lamb carcass weight is 20kg;
- **(c)** each 1 week earlier lambs are sold increases mean carcass price (for the total flock) by 4c/kg. Shearing prior to mating or at housing reduces the age at slaughter by one and two weeks, respectively;
- **(d)** the opportunity cost of grazed grass is 5c/kg grass dry matter; and ,
- **(e)** the value of wool is €1.40/kg.

Based on these parameters, relative to shearing in May, shearing ewes prior to mating, or at housing increases profitability per ewe by €2.10 and €5.10, respectively, due to a combination of increased lamb carcass value, change in fleece value and opportunity value of grass not consumed. This increase in margin due to shearing prior to mating or at housing is equivalent to an increase in lamb carcass value of 11 and 26c/kg, respectively.

Summary

1) Shearing ewes at housing:

- **a)** increases lamb birth weight by 0.6kg;
- **b)** has no impact on lambing difficulty;
- **c)** increases lamb weaning weight by 1.9kg;
- **d)** reduces lamb age at slaughter by approximately two weeks;
- **e)** increases fleece weight by 0.3kg;

f) enables approximately 15% more ewes to be housed in a given area; and ,

g) increases gross margin by approximately €5.10/ewe.

2) Shearing prior to mating in September:

a) maintains some of the benefits of winter shearing; and ,

b) increases gross margin by approximately €2.10/ewe.

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Castrating Lambs Decreases Profitability

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In mid-season prime lamb production the objective is to achieve high levels of lamb performance cost effectively. High levels of lamb performance results in early drafting thus ensuring that all lambs are sold by the end of the grazing season. In Ireland, 73% of all lambs are sold between early May and late December. At lambing an imminent decision which is required is whether or not to castrate male lambs. There is a lot of evidence that leaving male animals uncastrated increases animals performance. However, there is a perception among some industry commentators, producer groups, marketers and meat processors that leaving male lambs entire may have a negative impact on subsequent meat eating quality. The aim of this paper is to present information on the effects of castration on male lamb performance and subsequent meat quality.

Rearing Males Entire Increases Performance

There is a lot of evidence that leaving male animals entire increases animal performance and improves efficiency of production. For example, in beef production using bulls, and which are slaughtered at 24 months, instead of castrates increased carcass weight by 41kg, carcass conformation classification (on a 5 point scale) by 0.4 points and reduced carcass fat classification (on a five point scale) by 0.7 points. A study was completed at Athenry on the effects of castrating male lambs on subsequent performance and carcass characteristics. This study was undertaken using 157 all-male litters in a mid-season prime lamb production system. In each of the all-male twins one lamb was chosen at random and castrated shortly after birth whilst its sibling was left entire. The effects of castration on animal performance are presented in Table 1. Leaving the male lambs entire increased weaning weight by 1.8kg, reduced age at slaughter by 16 days and resulted in leaner carcasses. The reduced age at slaughter due to leaving male lambs entire, is similar to the response obtained from feeding 17kg concentrate per lamb prior to slaughter.

The improvement in animal performance due to leaving male lambs entire occurred for no extra cost or labour input. The financial gain, from leaving male lambs entire, under current market conditions is equivalent to €6 per male lamb. The reduced fat classification is of benefit to consumers, as consumers have an aversion to fat when purchasing meat.

Table 1: Effect of castration on subsequent lamb performance

	Gender Category	
	Entire	**Castrated**
Growth rate (birth – 5 weeks, g/d)	282	256
Weaning weight (kg)	31.7	29.9
Sale date	8 August	24 August
Carcass weight (kg)	18.1	18.2
Kill-out (%)	43	44
Fat score	2.9	3.1

Hanrahan, 1999

Entire lambs will be about 2 kg heavier at weaning that castrated lambs

Castration has no Benefit on Meat Quality

There is a perception by some industry commentators, producer groups, marketers and meat processors that rearing male lambs entire may have a negative impact on meat eat quality. In 2010, Dr Seamus Hanrahan, former Head of the Sheep Research Department, undertook an extensive review of research studies published in the past 25 years which compared meat from castrate and entire male lambs. This review was published in 2010 in TResearch. Studies from the following countries; France, United Kingdom, New Zealand, Australia, Canada and Iceland, many of which are the main producers of lamb worldwide were reviewed.

There is no simple definition of meat quality, and assessment can involve objective measurements, such as chemical composition, instrumental measures of tenderness and/or subjective evaluation by trained taste panels or in-home evaluation by families. In his review Dr Hanrahan included a British study in which meat from male lambs reared on pasture and slaughtered at 20 weeks of age was evaluated by a trained taste panel, and by consumers in their own homes. It was concluded from that study that whilst the carcasses from the entire males were 1.2kg heavier they had significantly (23%) less fat. The trained taste panel failed to identify any difference in flavour, texture or overall

acceptability. The consumer evaluations were undertaken in their own homes and the results are presented in Table 2. The consumers concluded that meat from the entire males had better aroma and resulted in a better eating quality experience.

A subsequent British study, included in the review, evaluated leg joints from entire males slaughtered at 7.5 months and from castrate males, unweaned, slaughtered at 4 months. The comparison would be expected to favour the young castrates. The joints were evaluated by consumers in Britain, France and Iceland.

Table 2: Consumer evaluation of home cook lamb from entire and castrate males

	Aroma		Eating quality	
	Entire	**Castrate**	**Entire**	**Castrate**
Very much better than normal	33%	14%	34%	19%
Worse than normal	0%	0%	6%	17%

(after Hanrahan 2010)

The results presented in Table 3, conclude that the leg joints from entire males had a higher score for all aspects of the evaluation and a higher overall acceptability score.

Table 3: Evaluation scores of British lamb evaluated by British, French and Icelandic consumers

	Sex category	
	Entire	**Castrate**
Odour liking score	64.4	63.5
Flavour liking score	66.9	64.8
Tenderness liking score	62.3	60.2
Juiciness liking score	59.7	57.7
Overall acceptability score	66.0	64.6

(after Hanrahan 2010)

France is the main export market for Irish lamb. In the late 1990s a two year study was undertaken to address the concerns which French butchers had in relation to the declining quality of locally French-produced lamb carcasses in late autumn/winter. The meat trade there believed this decline in the meat quality of local lamb in late autumn/winter was due to the failure of producers to castrate males. The two year study concluded that castrating male lambs would not solve the problem and that factors other than gender were responsible for the late season decline in quality.

A recent study which was undertaken in New Zealand in the TResearch review evaluated meat from male lambs reared as castrates or entire and slaughtered from 4-24 months of age. The study showed that there was no evidence of any effect on meat quality, whether male lambs were reared entire or as castrates, until 13 months of age. Dr Hanrahan concluded from his extensive review of the literature that where lambs are reared on an all-grass diet and slaughtered by the end of the grazing season, leaving male lambs entire has no negative effect of meat quality, whether assessment is laboratory-based or through in-home consumer testing. It is often stated that no meat quality work on lambs was undertaken in Ireland. However, a study was undertaken in Northern Ireland in which hill lambs were finished on a range of systems. The castrate and entire lambs were 38 and 35 weeks old respectively when slaughtered. The effects of leaving male lambs entire on meat eating quality is presented in Table 4. Overall, acceptability of meat from the entire male was higher than meat from the castrates.

Table 4: Meat quality for entire and castrate male lambs

	Sex category	
	Entire	**Castrate**
Intensity of aroma	49.9	53.4
Intensity of flavour	49.5	55.3
Juiciness	48	47
Tenderness	56.6	53.2
Overall acceptability*	3.40	3.75

(Carson et al., 2005)

*3 = better than everyday quality, 4 = premium quality

Summary

1. Leaving male lambs entire:
    a. increases lamb performance;
    b. reduces age at sale by 16 days;
    c. increases margin per male lamb by €6;
    d. produces leaner carcasses; and ,
    e. does not impact on meat eating quality.
2. Based on an extensive review of published literature leaving male lambs entire that are reared on an all-grass diet and slaughtered prior to the end of the grazing season (December) has no negative effect on the eating quality of the meat.
3. Consumers have an aversion to fat, therefore, the leaner carcasses from entire males is of benefit when purchasing meat.

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Extended Grazing – An Alternative System for Low to Moderately Stocked Farms

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Reducing the costs of maintaining the ewe during pregnancy provides an opportunity of improving net margin from lamb production. Many lowland sheep farms have a low stocking rate (national average stocking rate is 8.7 ewes/ha), consequently there are opportunities to extend the grazing season. One of the main benefits of the temperate climate which prevails in Ireland is the ability to grow grass for most of the year. Recent costings have clearly illustrated that whilst grass is not a cheap feed to produce (when total costs of production are included) it still is 16% cheaper than grass silage. The aim of this paper, based on studies undertaken at Athenry is to outline the effects of extended grazing of ewes during mid-pregnancy on subsequent animal performance and on grass re-growth.

Herbage for Extended Grazing

Grass dry matter growth rate declines rapidly from August to approximately 0-10kg/ha per day from late October to mid-February depending on weather conditions. Consequently, to extend the grazing season between December and March, grass must be "built up" in late summer/early autumn. The quantity of grass which must be accumulated for extended grazing depends on date of sward closure, level of nitrogen (N) fertilizer applied and date of grazing. The earlier the closing date, the higher the yield regardless of grazing date. However, it should be noted that regardless of closing date, once the swards reach peak yield, subsequent herbage yield declines. The reduction in yield is due to senescence (leaf decay) exceeding leaf production from November onwards. Date of closure and date of grazing also impact on the proportion of dead material in the sward which is negatively correlated with feed value as determined by digestibility and intake characteristics. Earlier closing together with later grazing increases the proportion of dead herbage in the sward. Consequently, the feed value of extended grazed herbage is equivalent to medium (70 DMD) and low (65 DMD) feed value grass silages after early December and mid-January, respectively. At Athenry, the accumulation of herbage for extended grazing begins in early September when swards are either topped to 4cm or after cutting for silage, and receive nitrogen fertilizer (35 to 40 kg/ha) for grazing from mid December to early February.

The Effects of Year Round Grazing On Lamb Output

A major study was undertaken for four successive years to develop and evaluate a system of mid-season prime lamb production involving year-round grazing thus removing the requirement for winter housing and forage conservation. The systems evaluated included a traditional high stocked system involving winter housing and a lower stocked system where the sheep were kept at pasture all year by extended grazing during the winter months. The effects of system on stocking rate and lamb performance are presented in Table 1. System had no effect on litter size or the numbers of lambs reared per ewe put to the ram. However, stocking rate had to be reduced by four ewes/ha (27%) and consequently, lamb carcass output was decreased by 120kg/ha (26%).

Table 1: Effects of system of lamb production on animal performance

	System	
	Conventional	**Year round grazing**
Stocking rate (ewes/ha)	14.4	10.5
Duration of housing(days)	100	0
Mean lambing date	20 March	30 March
Litter size	2.17	2.24
Number of lambs reared/ewe to ram	1.77	1.78
Lamb carcass output (kg/ha)	469	349

(Keady et al 2009a)

Effects of Extended Grazing in Mid Pregnancy on Ewe and Lamb Performance

Many studies have been undertaken at Athenry to evaluate the effects of extended grazing ewes during pregnancy on ewe and subsequent lamb performance. Initial studies showed that extended grazing ewes during pregnancy increased lamb birth weight. However, recent studies (Table 2) have shown that ewes shorn at housing produce lambs that have similar weights at birth and at weaning as lambs from ewes which were extended grazed throughout pregnancy. Therefore, the heavier birth weight of lambs recorded previously from ewes which were extended grazed was due to reduced heat stress relative to ewes which were housed unshorn.

The feeding value of extended grazed herbage was evaluated in studies at Athenry. In terms of lamb weaning weight (which takes into consideration both lamb birth weight and subsequent growth rate) an allowance of 1.3kg of extended grazed herbage dry matter in mid pregnancy had the same feed value as 0.92kg of low and medium feed value grass silages (Table 3). Throughout pregnancy 0.8kg silage DM intake offered to housed shorn ewes had the same feed value as 1.8kg extended grazed herbage allowance (Table 2). These data clearly illustrate that the feed value of extended grazed herbage was no better than low or medium feed value grass silage and consequently the improvement

in lamb birth and subsequent weaning weights observed previously due to extended grazing was not due to the feed value of extended grazed herbage.

Table 2: The effects of extended grazing in mid, late and throughout pregnancy on subsequent lamb performance

	Management in mid and late pregnancy		
	Housed		Extended grazed
	Unshorn	Shorn	
Litter size	1.92	2.01	1.89
Birth weight (kg)	4.0	4.6	4.6
Weaning weight (kg)	31.9	34.1	34.0

(Keady et al 2007, Keady and Hanrahan 2009a)

Table 3: The effects of herbage allowance for extended grazing and grass silage feed value in mid-pregnancy on animal performance

	Herbage DM allowance (kg/day)		Silage feed value	
	1.0	1.8	Low	Medium
Forage intake (kg DM/day)	0.41	0.58	0.99	0.91
Herbage utilisation (%)	46	35	-	-
Ewe condition at lambing	2.83	3.07	3.14	3.07
Litter size	1.91	1.85	1.84	2.05
Lamb birth weight (kg)	4.47	4.93	4.52	4.50
Lamb growth rate (g/day to weaning)	294	311	302	315
Lamb weaning weight (kg)	33.6	35.6	34.2	34.7

(Keady and Hanrahan, 2009b)

Effect of Frequency of Grass Allocation on Ewe Performance

One of the advantages often quoted for extended grazing is the reduced labour requirement relative to feeding ewes which are housed. Normally herbage is allocated daily which can be time consuming (particularly for large flocks) as fences (Flexinet) need to be erected ahead of the ewes and the back fences have to be moved. In order to evaluate if labour input can be reduced the effect of frequency of herbage allocation on forage intake and animal performance has been evaluated in recent studies at Athenry (Table 4). During extended grazing (mid-December to four weeks prior to lambing) the ewes were allocated herbage either daily or twice weekly. Frequency of herbage allocation did not alter

forage intake or utilisation. Furthermore frequency of herbage allocation had no effect on lamb birth or weaning weights, or lamb growth rate from birth to weaning.

Table 4: The effects of frequency of herbage allocation in mid-pregnancy on herbage utilisation and animal performance

	Frequency of herbage allocation	
	Daily	**Twice weekly**
Herbage utilisation rate (%)	38	41
Ewe condition score at lambing	3.0	2.9
Lamb birth weight (kg)	4.7	4.7
Lamb growth rate (g/day to weaning)	300	304
Weaning weight (kg)	34.4	34.8

(Keady and Hanrahan, 2009b)

As the national average weaning rate is about 1.3 lambs per ewe put to the ram most flocks are comprised of ewes which produce only singles and twins. As many sheep producers scan their flocks for litter size in mid pregnancy they can group ewes accordingly. An on-farm study was undertaken by Teagasc to evaluate the effects of allocating herbage daily to single and twin bearing ewes in late pregnancy, either grouped separately (according to litter size) or in a leader-follower system (twin-bearing ewes were leaders followed by the single bearing ewes). The daily herbage dry matter allowances per ewe for weeks 7 to 6, 5 to 4, 3 to 2 and prior to "spread out" for lambing were as follows: 1.3, 1.4, 1.6 and 1.6 kg for single bearing ewes grazed separately; 1.4, 1.6, 1.9 and 2.7 for twin bearing ewes grazed separately; 2.7, 3.0, 3.5 and 4.3 for the twin bearing ewes followed by single bearing ewes in the leader-follower system. Allocating grass daily to the single- and twin-bearing ewes separately or in the leader-follower system did not affect lamb birth weight, incidence of lambing assistance, lamb growth rate or weaning weight (Table 5). However, single bearing ewes in the leader-follower system had a lower condition score at lambing. The leader-follower system reduced labour requirements by decreasing the number of fences required to be erected by 50% in a flock of predominantly single and twin bearing ewes.

Table 5: Effect of grass allocation management in late pregnancy on animal performance

	Grassland system			
	Leader-follower		Separate	
Litter size	Twin	Single	Twin	Single
Ewe condition at lambing	3.12	2.93	3.00	2.93
Lamb birth weight (kg)	4.95	5.80	4.80	5.97
Lamb growth rate (g/day)	228	269	224	266
Weaning weight (kg)	27.6	32.4	27.1	32.4

(Keady and Hanrahan, 2009b, 2011)

Extended grazing has a negative effect on sward botanical composition. A recent study at Athenry showed that delaying the date of extended grazing after early December decreased the content of perennial ryegrass whilst increasing the contents of cocksfoot and meadow grass.

Effect of Extended Grazing Management on Subsequent Herbage Yield

In an all-year- round grazing system grass supply will be most limiting in autumn. Grass supply is also a major concern for the first two months after lambing. Consequently, the effects of extended grazing management on herbage yield during the early part of the subsequent grazing season impacts on potential stocking rate. The effect of extended grazing management on herbage yield early during the subsequent grazing season was evaluated at Athenry. Increasing daily herbage dry matter allowance from 1.0 to 1.8 kg/ewe at grazing increased subsequent herbage dry matter yield by 1.14t/ha (Table 6). Frequency of herbage allocation during extended grazing did not affect subsequent herbage yield (Table 6). However, each 1 day delay in grazing date reduced herbage dry matter yield by 54.2kg/ha (Figure 1) which is equivalent to 18 ewe grazing days. The data from this study clearly illustrated that delayed grazing had a major effect on subsequent herbage yield.

Table 6: Effects of extended grazing management of autumn saved pasture on dry matter yield in spring

	Herbage DM allowance (kg/day)		**Frequency of allocation**	
	1.0	**1.8**	**Daily**	**Twice weekly**
Dry matter yield (t/ha)	2.3	3.2	2.7	2.8

(Keady and Hanrahan, 2009b, 2011)

Effect of Extending Grazing on Pasture Damage

In extended grazed pastures which had been grazed between mid December and late January, grazing date and herbage allocation at grazing impacts on pasture damage. When assessed in early April the percentage of the sward which was categorised as bare ground varied from 3% to 22% for pastures grazed at high (1.8kg/ewe daily) and low (1.0kg/ewe daily) herbage dry matter allowances the previous winter. However, by mid May the percentage of bare ground was reduced to 5.5 and 8.8%, respectively. Frequency of herbage allocation has no impact on the proportion of bare ground (indication of sward damage) the following spring.

Extended grazing has a negative effect on sward botanical composition. A recent study at Athenry showed that delaying the date of extended grazing after early December decreased the content of perennial ryegrass whilst increasing the contents of cocksfoot and meadow grass (Table 7).

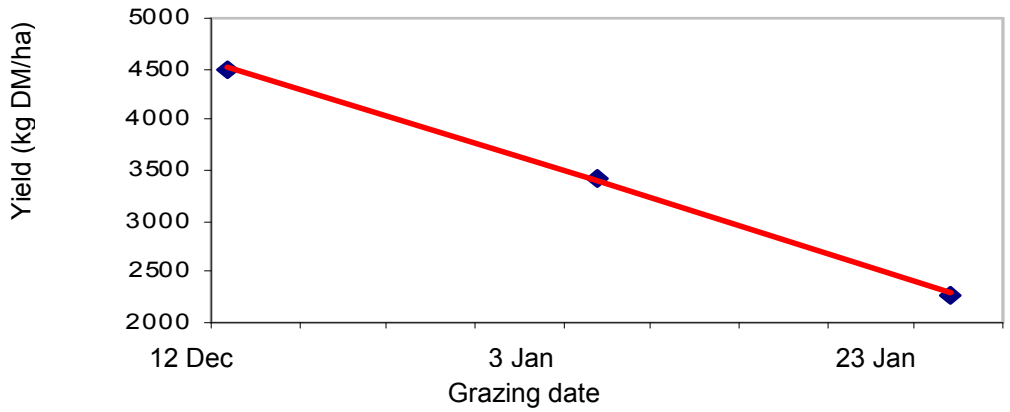

Figure 1. The effects of grazing date on herbage yield early during the subsequent season

Table 7. Effects of date of extended grazing on herbage botanical composition (%)

	Defoliation date			
	Early December	**Mid-December**	**Mid-January**	**Mid-February**
Perennial ryegrass	71	67	62	59
Cocksfoot	16	18	21	22
Meadow grass	9	6	11	12
Yorkshire fog	6	8	5	6

(Keady et al., 2010)

Summary

1. It is concluded that an effective year-round grazing system can be practiced successfully. However, stocking rate is reduced significantly, consequently, dramatically reducing lamb carcass output/ha and gross margin/ha. However, to comply with the Nitrates Directive adequate slurry and/or farmyard manure storage facilities for a six week period is required.
2. Extended grazing:
    - **a**. increases lamb birth weight relative to lambs from housed unshorn ewes;
    - **b.** limits stocking rate to a maximum of 10 ewes/ha;
    - **c.** requires excellent grassland management to be successful;
    - **d**. provides a low cost system, particularly for 'flying' flocks;
    - **e**. is a relatively inefficient system of utilising herbage; and ,
    - **f**. reduces the proportion of perennial ryegrass in swards.

3. Allocating herbage twice weekly rather than daily has no effect on animal performance or subsequent herbage growth.
4. Concentrate supplementation is still required to enable the year-round grazing system to succeed.
5. The improvement in lamb birth and weaning weights due to extended grazing can be achieved indoors by shearing ewes at housing.

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Labour Management on Sheep Farms

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Many farmers generally are of the opinion that there is too much work involved with sheep production. However, there is much evidence that the work burden can be significantly reduced and productivity increased on many farms by the adoption of a number of labour saving practices. Many of these practices are not costly to implement. It is worth examining ways of reducing the workload on the sheep farm and taking any corrective action deemed necessary. There are many factors that can help reduce the workload on a sheep farm. Breeding for easy care traits may play a part in the future but further studies are required to quantify benefits. For the larger scale producer a quad bike is very useful and some would even say essential. It can simplify tasks such as taking a ewe with young lambs to or from the fields, taking out feed and even gathering the flock. However, there are several potential labour saving options that are under the farmers immediate control and often cost little money. For farmers who wish to remain in or indeed expand sheep farming, these issues should be carefully examined to see how they might apply at farm level.

Factors Under your Immediate Control

1. Erecting Stock Proof fencing
2. Providing effective handling facilities
3. Adoption of good management skill and practices
4. Obtaining a well-trained sheep dog

Stock proof fencing is essential to implement a grazing plan and for overall flock management

Stock Proof Fencing

Stock proof fencing is essential for any livestock farmer. It is vital to implement a grazing plan and to ensure the flock remains in the designated place. There is little point in talking about grazing heights if your fences are not capable of controlling your stock. Proper fencing will also facilitate creep-grazing lambs ahead of ewes. By this system lambs can be up to 2kg heavier at weaning, resulting in being fit for sale two weeks earlier, at little extra cost.

Effective Handling Facilities

A good handling unit can save 1 to 1.5 hours per ewe per year. For a flock of 150 ewes this is equivalent to five weeks work. However, the real benefit arises from the greater likelihood that management tasks such as dosing and foot bathing will be completed in time. The facility will also encourage the checking of ewe body condition at critical times of year, allowing corrective action such as better feeding, be taken. Fragmented holdings have been blamed in the past by farmers for not installing proper facilities. However, there are some excellent mobile units on the market which can be transported easily from one block of land to another. This equipment doesn't have to be very elaborate but some basic facilities will be of great benefit. There are several aspects to consider when erecting a handling unit. Teagasc advisers throughout the country will be able to help with the design.

A good handling unit can save 1 to 1.5 hours per ewe per year and for a flock of 150 ewes this is equivalent to five weeks work

Adoption of Good Management Skill/Practices

Several management factors can contribute greatly to reducing labour requirement. In most cases these factors will also help increase profits. Having ewes in good a body condition score at lambing will ensure healthier and stronger lambs at birth. The ewes will also produce more milk ensuring better subsequent lamb performance. A stronger lamb at birth also saves labour, with less time required to help lambs to suckle or, even worse, providing supplementary feeding for lambs whose mothers have an inadequate milk supply. To ensure that ewes are in good condition at lambing, a target condition score of 3.5 at mating is required. This will lead also to higher litter size, higher weaning rate and ultimately higher profit.

To ensure an adequate supply of quality grass, a planned grazing programme is required. While this takes time and effort, a good supply of quality grass for ewes with young lambs will save on expensive concentrate. It will also save time feeding and avoid mis-mothering of lambs. Winter (December) shearing of ewes will contribute to stronger, heavier and healthier lambs that will need less attention and will be ready for sale earlier in the season. Any ewes loosing body condition will be easy to identify allowing timely corrective action to be taken. Winter shearing will also reduce the cost of housing as more ewes can fit into a given space.

Obtain a Well-Trained Sheep Dog

A well trained sheep dog is a major advantage when working with sheep. Whether gathering sheep, moving sheep from one paddock to another or singling out sheep in the field, a well trained dog saves a huge amount of stress and time. However, it is equally important that the handler knows how to properly operate the dog. Teagasc regularly run sheep dog training courses where clients will learn how to train their own dog and also acquire improved handler skills.

Conclusions

Sheep production is an enterprise with significant income potential if done well. While many farmers are of the opinion that there is too much work involved with sheep production, the work burden can be significantly reduced and productivity increased by the adoption of a number of both labour saving and good management practices, many of which are not costly to implement. Your Teagasc adviser can help you analyse current labour and flock management practices and devise effective new practices.

Lamb Drafting and Market Specifications

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Sheep farmers have experienced a welcome increase in sheep prices in the past few years mainly driven by a drop in world sheep meat supplies. However, to maintain lamb prices at the higher end of the red meat price spectrum we must ensure that lamb is produced to meet the market specifications that satisfy consumer demand.

Lamb Markets

- 70% of the national lamb output is exported with the French and UK being the most significant markets for Irish lamb. The French market alone accounts for half of all Irish lamb exports.
- The proportion of exported lamb sold as chilled boneless lamb has increased in recent years with over 30% of total exports now sold in this form. There has been a growth in exports to markets in Northern and Central Europe. While these markets are still small in volume they are high value markets that demand the higher value boneless cuts.

The Irish lamb market accounts for 30% of total national output and this market has grown in importance as sheep numbers have declined. There has been a decline in volumes sold on the home market since 2008 but current indications are that this trend is now being reversed.

Market Specifications

The market specifications for different markets are outlined in Table 1.

Live Sheep Exports

Live exports of sheep dropped from over 97,000 head in 2009 to under 50,000 in 2010. Demand for live sheep exported from Ireland revolves mainly around Muslim festivals. The dates for the Muslim festivals that influence the live lamb shipping trade vary from year to year.

Specifications for Muslim Markets

Lamb type: Long tailed ram lambs; Weight range: 44–55 kg.

R, U conformation with good flesh cover.

Each market has distinct requirements, but in general all markets require lambs that are within a weight specification, have good conformation (R/U) and are not overfat. By improving the proportion of lambs that meet these market specifications the Irish lamb industry can improve overall returns and

add to the sustainability of the Irish sheep sector. Lamb producers must target the markets they wish to supply and present even lots of lambs that meet those market specifications in terms of weight, conformation and fat cover.

Table 1: Market Specifications

Supermarket Specification	**Butcher Lamb**	**French Lamb**
Weight range: **18-21kg** EUROP Grade: **E3, U3, R3** Season: **All year (weight range varies over course of season)**	**Urban** Weight range: **19-21kg** Fat score: **2-3** **Rural** Weight range: **22-25kg** Fat score**: 2-3**	Weight range**: 16 – 22kg** Season: **All year (weight range varies over course of season)** EUROP Grade: **E2/3, U2/3, R2/3,R2H** Age: 12 weeks +
Spring lamb	**Light lamb**	**Milk Lamb**
Weight range: **16 –20kg** Season: **April - June** Fat Score**: 2/3** Confirmation: **E/U/R** Age: **12 weeks +** Suitable breeds: **Lowland breeds** Market destination: **Home& Export markets**	Weight range: **8 -12.5kg** Season: September onwards Fat Score: **2/3** EUROP Grade: **E2/3, U2/3, R2/3, O3** Market destination: **Italy, Portugal, Spain and Irish markets**	Weight range: **9 – 12kg** Season: **Early – Easter trade** EUROP Grade: **E2, E3, U2, U3, R3** Age: 5 weeks + Market destination: **Belgium, France**
Belgian	**Germany**	
Weight range: **16-19kg** EUROP Grade: **E2, E3L, U2, U3L**	Weight range: **17-20kg** EUROP Grade: **E2, E3, U2, U3, R2, R3**	

Source: Bord Bia, 2010

Selecting Lambs for Slaughter

Profits can be maximised by consistently supplying lambs that satisfy the customer's needs. In recent years, average carcass weights have increased with a high proportion of lambs now exceeding the maximum weight paid for. There is a strong relationship between carcass weight and conformation and also between carcass weight and fatness. Selecting for heavier carcass weights increases the risk of over fat carcasses unless lambs are of a type and breed that can produce heavier lean carcasses.

Handling and weighing lambs regularly is an essential practice for sheep farmers to gain knowledge as to how lambs are thriving and killing out. Regular weighing and handling will avoid lambs been drafted that are over weight, poor conformation, over fat or under fleshed.

The following routine is recommended:

- Weigh and handle for fat cover:

  Pre weaning – weekly; and ,

  Post weaning – fortnightly.
- Know your target carcass weight and draft within a 5kg weight range
- Estimate kill out % (See Table 2)

Table 2: Kill out rates (%) for lambs of different ages

Lamb Age	**Estimate Kill-Out %**
Pre-Weaning	
10-13 weeks	50%
14 Weeks	48%
Post-Weaning	
Late Summer	45%
Autumn/Winter	43%

Regular weighing and handling will avoid lambs been drafted that are over weight, poor conformation, over fat or under fleshed

Other Factors Influencing Drafting Weight Include:

- Meal fed lambs will kill out 1 – 2% higher than grass only fed lambs;
- Single lambs will reach slaughter weight faster and will be over 1kg heavier at the same level of fatness than lambs born and reared as twinsEwe lambs are lighter at the same level of fatness, generally have a higher KO% than males and should be selected at 2 kg lighter weights for slaughter;
- Entire males can be brought to heavier carcass weights at the same level of fatness;
- Fatter lambs have a higher KO% than lean lambs;
- Lambs with long loose fleece will have lower KO%; and ,
- Lamb with long tails, testicles or horns have a lower KO%.

Carcass on the left is de-valued as a result of bruising from rough handling

Clean lambs for slaughter

Avoid presenting dirty sheep for slaughter. The tail area in particular should be free from faecal contamination and daggings. Dirty animals should be dagged or crutched before sale and animals grazing autumn/winter forage crops belly clipped to avoid soil contamination. Prevent lambs becoming dirty on transit by fasting the animals for one hour prior to transporting and transport in a clean dry vehicle.

Present clean lambs for slaughter

Incorrect Handling

Correct Handling

Handling Lambs

Careful handling of live sheep is important as sheep bruise easily, especially young lambs, and damage to carcases reduces the animal's value. Do not handle or move sheep by grabbing the wool. This practice often creates a surface bruise that requires part of the carcass to be trimmed or discarded resulting in carcass weight loss and or a devaluing of the whole carcase. Over loading or over crowding sheep in pens or in transport vehicles can result in sheep being trampled resulting in bruised or damaged carcases.

Replacement Policy and Management

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On average 20% of the ewe flock is replaced annually. Replacement cost is a substantial cost in sheep production and in the 2010 e–Profit Monitor flocks (Table 1) the average replacement cost was estimated at €17 per ewe. However, there is a huge variation between farms.

Table 1: 2009 e-Profit Monitor Replacement Costs

	Top ⅓	Average	Bottom ⅓
Replacement cost per ewe	**€6**	**€17**	**€27**

Replacement Options

Sheep farmers have a number of options to acquire flock replacements including:

- **(a)** Purchasing ewe hoggets at 18 months of age;
- **(b)** Rearing their own ewe lambs or purchasing ewe lambs and mating them as hoggets at 18 months of age (Dry Hogget); or ,
- **(c)** Breeding ewe lambs in their first season.

The estimates of the cost associated with each of the three systems are set out in Table 2.

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Table 2: Replacement Costs

	(a)Hogget Purchased	(b)Dry Hogget	(c)Ewe Lamb Mated
Ewe lamb value		€95	€115
Purchase value of hogget	€190		
Feed costs		€38	€62
Veterinary & other costs	€ 5	€7	€15
Total costs	€195	€140	€192
Cull ewe and lamb value	€ 85	€ 85	€ 160
Nett Replacement cost	€ 110	€ 55	€ 32
Annual replacement cost / mature ewe	€22	€13.75	€8.00

Advantages and Disadvantages

The advantages and disadvantages of different options are outline below.

Purchasing hogget replacements

Advantages

- All lambs are from mature ewes (2+ years) and more lambs are sold per ewe kept with tighter drafting.
- Simplifies flock management and allows the flock owner to concentrate on producing lambs for slaughter with terminal sires.
- The flock managed as one unit makes grassland and flock management easier.
- Suitable system for small to medium-sized flocks; in these flocks small sub-flocks make grassland and general flock management more difficult.

Disadvantages

- Significant disease and bio-security risk unless they come from a reliable source.
- Flock owner has no control of selecting animals with improved genetics for increasing productivity and flock health.
- High annual capital outlay on purchasing replacements.

Dry Hoggets

Advantages

- Both a low labour and low cost system.
- All lambs are from mature ewes resulting in higher growth rates and more compact lamb drafting.
- Allows later born or light ewe lambs (e.g., lambs from hill breeds) to grow and reach target weights for mating at 18 months.
- In closed flocks, facilitates selection of replacements with good maternal traits at weaning.
- Dry hoggets can be used to maintain grass quality for the lambed ewe flock.

Disadvantages

- Lower life-time performance when run as dry hoggets in first season.
- Lighter lambs may be selected as replacements. Research shows that slow growing animals that are under nourished pre weaning are less prolific during their later productive life time.
- Fewer lambs sold as 20% of the flock is not bred.

Research shows that slow growing animals that are under nourished pre-weaning are less prolific during their later productive life time

Breeding Ewe Lambs

The increased lamb prices and the high cost of replacements in recent years have prompted increased interest in breeding ewe lambs. A number of key targets must be achieved to ensure successful breeding of ewe lambs. The advantages /disadvantages of breeding ewe lambs are outlined below.

Advantages:

- Ewe's lifetime production is increased by up to 20%;
- Hoggets are easier to manage in the second year;
- Allows for faster genetic gain when selecting within a closed flock; and,
- It increases profits by reducing replacement costs.

Disadvantages:

- Higher labour requirement especially at lambing;
- Extended and later lambing period;
- Lower lamb output from ewe lambs;
- Must be managed as a separate flock; and ,
- Not achieving live weight targets at 1.5 years can result in lower lambing % in the second season and fewer lambs over the ewe's lifetime.

Puberty and Oestrus in Ewe Lambs

There are numerous interacting animal and environmental factors that affect timing of puberty and onset of oestrous cycles in ewe lambs. The more important ones are briefly summarised below.

Day length and season: Ewe lambs are more likely to reach puberty and commence oestrous cycles and at lower live weight with shortening day length e.g., Suffolk type ewe lambs will reach puberty at 44kg live weight in early October and at 33kg in early December.

Breed differences: Research shows there are breed differences in the age at start of cycling. The maternal breeds will reach puberty and show oestrus at a younger age than terminal sire breeds. e.g., Suffolk crosses 240 days vs Finn crosses 189 days.

Age: Compared to mature ewes, ewe lambs begin oestrous cycles later in the breeding season. Furthermore, their breeding season is also shorter. Conception rate is low if ewe lambs are under 7/8 months of age at time of breeding. A target ewe lamb mating weight should be 60% of mature body weight for that breed type and these are summarised in Table 3 for some breed types.

Ram effect: Introducing teaser rams for a two week period in October/early November will advance onset of puberty and will result in more compact mating and subsequent lambing.

A ewe's lifetime production is increased by up to 20% when initially bred as a ewe lamb. Mating ewe lambs can increase farm output, but requires extra management to ensure subsequent performance is not compromised

Table 3: Target ewe lamb mating weight and mature ewe body weight

Breed	Mature Body Weight (kg)	Weight at mating as ewe lamb (kg)
Lleyn	65	40
Mule/Greyface/ Belclare cross	75	45
Suffolk/Continental cross	80	48

Shearing

Trials by ADAS (UK) 1995 showed a response to shearing where ewe lambs were shorn in mid-September and exposed to rams for three cycles from mid-October (Table 4).

Table 4: Effect of shearing ewe lambs on % barren and % producing twins

	Shorn	Unshorn
Barren (%)	10	30
Twins (%)	27	19

Shearing increased the % of ewe lambs that subsequently lambed and also the % that produced twins.

Mating Management

Farmers planning to breed ewe lambs should introduce fertile ram(s) to the ewe lambs two weeks after ram introduction to the mature ewe flock. Ideally, introduce teaser rams 17 days before entire rams. The teasers will induce oestrus so more ewe lambs will mate in the first 17days after fertile ram introduction. It is preferable to mate ewe lambs separately and use one mature ram per 25 ewe lambs. Use easy lambing breeds or select rams with high easy lambing breeding values (Lambplus performance records) or a record of easy lambing. Limit the breeding period to 35 days. The combined lower ovulation rates and higher embryo mortality in ewe lambs compared to mature ewes, will result in up to 20% of ewe lambs failing to become pregnant. The target litter size for ewe lambs becoming pregnant is 1.25 – 1.3 lambs thus giving an expected weaning rate of 0.8-1 lamb per ewe lamb joined with rams.

It is preferable to mate ewe lambs separately and use one mature ram per 25 ewe lambs. Limit the breeding period to 35 days

Ewe lambs differ from mature ewes in they need to continue to grow throughout pregnancy and at the same time produce a viable healthy lamb. They need to be treated and managed as a separate flock from the time they are mated as ewe lambs until they are re-mated the following year as one-and-half-year-old-hoggets.

Maintain ewe lambs on a high plane of nutrition (good quality autumn grass) during and for a month post-mating. In the second and third month of pregnancy a diet from winter-grazing or good quality silage is sufficient to give a weight gain of 0.6kg per week. Scan at 80 days from ram introduction and base the feeding programme for the last eight weeks of pregnancy on litter size. Feed meals to single bearing ewe lambs from 8 weeks pre lambing at the rate of 0.25kg/day. Concentrate levels should be increased to 0.5 kg/day for twin bearing ewe lambs. Frequently check for body condition score and adjust feed levels accordingly.

Post Lambing

Ewe lambs (now hoggets) rearing lambs should be managed separately after turn out in spring and fed 0.5kg of concentrates daily for a few weeks post turn out. Introduce creep feed to their lambs from turnout and feed 300 gm per head daily up to weaning. Wean when lambs are 12-13 weeks of age. This allows weaned hoggets regain body condition and achieve a target body weight of 80% of mature body weight (65 kg) at second mating. Increasing the group size by mixing hoggets with triplet rearing ewes will facilitate better grassland management.

Ewe lambs fail to develop immunity to gastro intestinal parasites (stomach worms) during pregnancy and first lactation. The parasite burden should be monitored through taking faecal samples at 4-6 week intervals and dosing when faecal egg counts indicate a high parasite burden.

Irish Breed Comparison Studies – a Review

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Research has shown that substantial increases in ewe and ram productivity are achievable through the right combination of breeds. However, the industry still lacks clear breeding policy. This can be seen clearly in the replacement strategy of the BETTER farm data where at least three different breed types were used on every farm and some were using as many as five thus indicating that farmers are confused by the breeding choices that are out there. The aim of this paper is to review some of the Irish studies that have been conducted to date and to thus aid farmers in making breeding decisions.

Ewe Performance

Extensive breed evaluations have been undertaken over a 25-year period in Teagasc using flocks in Blindwell, Belclare, Knockbeg and Athenry. This led to the development of an efficiency index by Seamus Hanrahan. This index takes into account the number of lambs weaned and ewe body size. Ewe body size was included to penalise against heavier ewes that have greater maintenance requirements across their lifetime. The results for the main ewe breed types is summarised in Table 1.

Table 1: Breed of sire ranked on an efficiency index with the Belclare cross ewe used as the base (Hanrahan, 2010)

Breed type	Litter size	Lambs reared per ewe joined	Ewe live weight (kg)	Efficiency index
Belclare cross	2.00	1.70	63	100
Charollais cross	1.86	1.61	67	87
Vendeen cross	1.75	1.54	66	86
Blue Leicester cross	1.85	1.56	70	84
Bleu du Maine cross	1.75	1.50	66	84
Texel cross	1.70	1.49	67	83
Suffolk cross	1.80	1.51	69	82

Number of lambs reared per ewe has been identified as one of the main indicators of profitability on farm; therefore a large amount of research conducted to-date has focused on increasing the prolificacy

of the ewe flock through breed selection. Results to date show that on average the Belclare cross ewe rears 0.1 more lambs than their nearest contemporary. If the Belclare cross ewe is compared to the dominant breed type of the Suffolk cross ewe this figure increases to 0.2. Results from research conducted in Northern Ireland have shown that the Blue Leicester crossed with the Scottish Blackface is also a high prolific breed capable of producing 1.99 lambs per ewe lambed (Carson *et al;* 2004).

Teagasc studies have shown that Belclare cross ewes can consistently wean 1.70 lambs per ewe joined

Ram Performance

The choice of ram used in a given flock can affect lamb growth rate, the number of days to slaughter and the conformation classification. A comparison of the main terminal sire breeds is summarised in Table 2. Overall results show that Suffolk cross lambs have the highest weaning weight and this resulted in the progeny being drafted for slaughter at a younger age. Texel cross lambs had the highest carcass weight at a fixed fat score but the differences in kill out percentage between the breeds was quite small. A recent study conducted by Hanrahan (2010) involving 45 pedigree Suffolk and 55 pedigree Charollais progeny tested rams has shown that the rams genetic potential had little effect on the progeny weight at 120 days with 80% of the rams tested progeny falling within ±0.5 kg of the overall mean.

When compared to the traditional terminal breeds, Belclare sired lambs were significantly lighter at birth and have lower although non-significant growth rates to weaning (281g/day) compared to the traditional terminal breeds of the Suffolk (288g/day) and Texel (293g/day; Hanrahan, 1999).

Table 2: Terminal sire breeds on their production performance with the Suffolk used as the base

Sire breed	Weaning weight	Sale date	Carcass weight	Carcass conformation	Kill-out rate
Suffolk	100	100	100	100	100
Texel	96	104	102	100	102
Charollais	97	102	101	100	102
Beltex	96	106	98	106	102
Dorset	99	100	100	91	100
Ille de France	95	108	101	103	103
Bleu du Maine	92	107	99	96	100
Rouge de l'Ouest	95	105	100	98	100
Vendeen	94	106	100	98	101

(Hanrahan, 1999)

Therefore, in summary research to date has found little overall differences between the main terminal sire breeds that are widely used in Ireland (i.e. Texel, Suffolk and Charollais).

Health Traits

Breeding sheep that are resistant to certain health issues is now achievable; recent research has shown that variation exists within and between breeds for resistance to nematode parasites. In Ireland results have shown that Texel breeds are more resistant to nematode challenges compared to Suffolk breed both as lambs and adult. Good *et al*; (2006) concluded that the differences in resistance between the two breeds are most likely due to genetic variation and the exploitation of this variation through breeding can be used as a management tool in the future for the control of parasites.

What Breed is Right for Me?

Unfortunately there is no one breed that fits all! The breed of animal used on your farm should however be suitable for your production systems. For example the Belclare cross ewe will lift the lambing output but this may not be suitable for all farmers due to the greater labour requirements at lambing time and the subsequent rearing of triplets. Also, the type of ewe that is suitable for high stocking rate systems may not necessarily be the same ewe that is suitable for low stocking rates. An

important question to ask yourself is what is my end goal in my production system and how can I achieve this most efficiently.

Summary

Although this article has focused mainly on breed comparisons it is important to acknowledge that a new national genetic evaluation is operation for sheep in Ireland, the Sheep Value Index. This index will focus in the future on across breed evaluations therefore if farmers are selecting the best genetic merit animal with a high accuracy then selecting on an individual breed will become irrelevant.

Current and Future Developments in Irish Sheep Breeding

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It is well established that approximately half of the production gains achieved in animal performance is attributable to genetic improvement. Genetic improvement is cumulative and permanent so that if you were to use animals with "good genes" then the effects of these "good" genes will remain in the flock. On the downside the reverse is also true, if an animal of low genetic merit is used within the flock then these "bad genes" are there to stay!

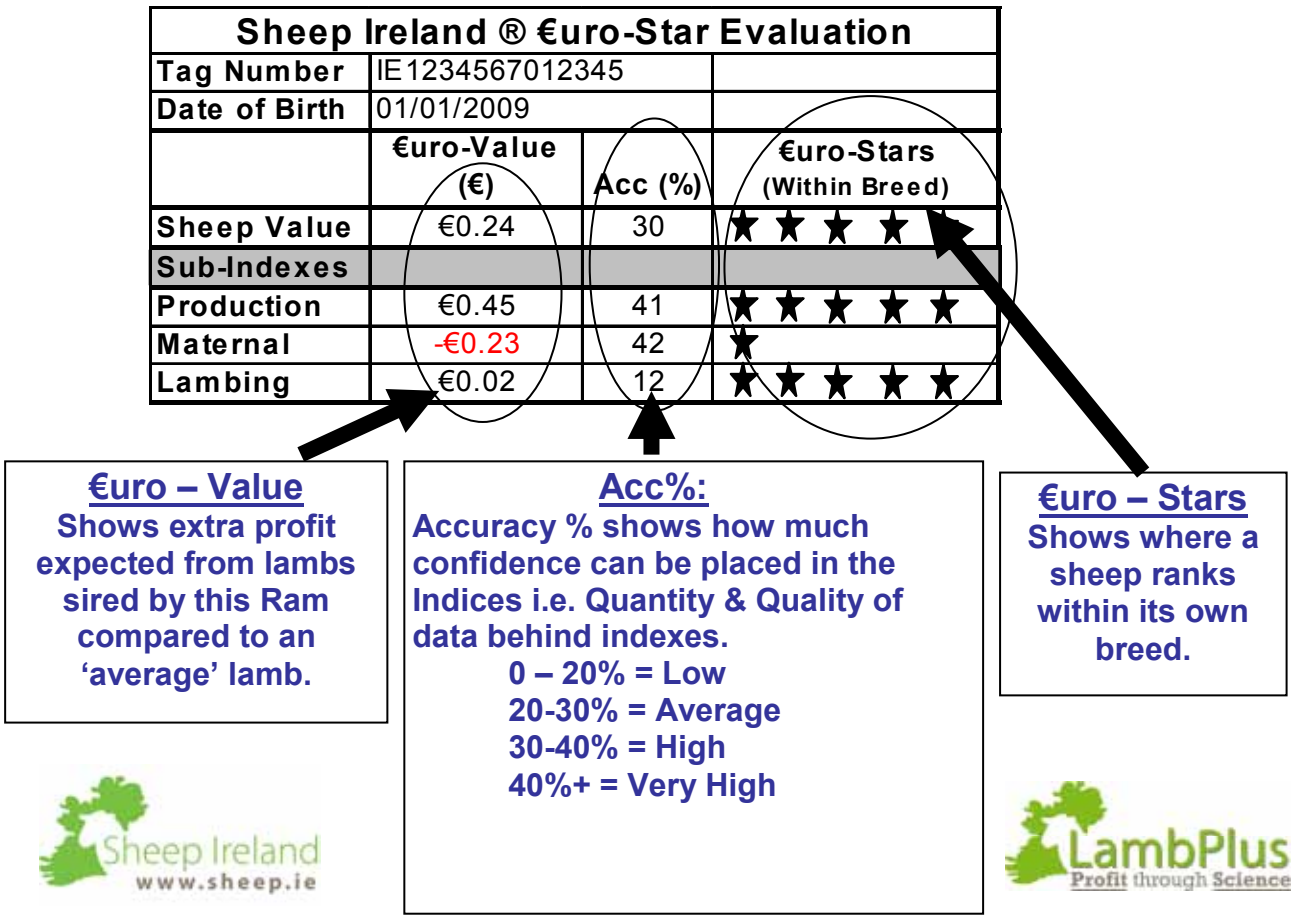
Sheep Ireland

The contribution of genetics to profitable farming can be witnessed first hand in both the dairy and beef sectors in Ireland. With this in mind Sheep Ireland was established in 2007 to initiate a dynamic breeding programme for the Irish sheep industry and increase flock productivity and profitability. In the past the true genetic merit of some pedigree animals may have been masked due to the intensive or selective management of these animals. The current genetic evaluations established by Sheep Ireland focuses on breeding animals for the commercial flocks. Part of the new breeding programme included the establishment of two recording initiatives, the central progeny test (**CPT**) and maternal lamb producer (**MALP**) groups. Within the CPT flocks pedigree ram from a diverse spread of recording flocks are mated to a central group of commercial ewes and the subsequent performance of all progeny are recorded in detail. The MALP flock's involves the recording of data on progeny of sires that are used across a range of commercial farms and thus helps to identify ram of superior and inferior genetic merit across different production systems.

The aim of the national breeding programme is to produce a low cost, easy care sheep with good maternal characteristics, but yet will produce a quality lamb with high growth rates that will reach slaughter at a young age. Data on the traits of interest are recorded across a range of commercial and pedigree flocks and the weighting of each trait is dependent upon its relative economic importance to overall flock profitability. All economically important traits are then summed into three sub-indexes which in turn are summed into an overall breeding index. This index is the tool to help farmers in making more informed breeding decisions that can increase flock profitability.

Sheep Value Index and Sub-Indexes

The overall Sheep Value Index is based on the €uro-star system which acts as an indicator of the profitability that can be obtained from the animal's progeny. The €uro-stars are scored on a scale of 1-5 and compares all animals within each breed; a one star indicates that the animal lies within the bottom 20% of ranked animals for the given trait and a 5 star corresponds to the top 20% of animals.



Summary of Sheep Ireland's Euro-Star Evaluation

Sheep Value Index – this is the overall index for each animal and encompasses the three sub-indexes each weighted based on relative importance:

1. ***Production Sub-index*** – ranks animals based on their ability to produce good terminal progeny. This takes into account the progeny's growth rate, carcass characteristics and days to slaughter.
2. ***Maternal Sub-index*** – ranks animals on the expected performance of their daughters and takes into account the daughters' mothering ability, the ease of lambing, and the efficiently at which their progeny are finished.

3. ***Lambing Sub-index*** – ranks animals for lambing traits and takes into account the lambing ease and survivability of the animal's lambs.

How to Use the Indexes

Prior to using any index, each farmer must determine the most suitable animal for their production system. The next question is how to achieve that ideal animal. For example, if farmers are interested in finishing all their lambs for slaughter then they should pay particular attention to the Production Sub-Index of the animal under consideration. On the other hand, if a farmer is looking to breed their own replacements then they should examine the Maternal Sub-Index carefully. Irrespective of the type of animal that is needed, careful attention should be placed on the star rating of the animal and the accuracy associated with the trait of interest. The higher the accuracy of the given trait the greater the information that is known about the animal and the greater the confidence producers can have that their published index value reflects their true index value.

Teagasc's Future Role in Sheep Breeding

Although a considerable amount of work has been undertaken in sheep genetics in Ireland, on-going research is required to further demonstrate the importance of sound breeding decisions on profitability. Key areas of research for Teagasc include development of breeding objectives and breeding programmes to continuously increase genetic gain in profitability across generations. Access to large quantities of accurately recorded data is one of the main obstacles to accurate genetic evaluations in Ireland and, therefore, resources and greater farmer cooperation are required to increase the level of recording especially for difficult to measure traits. Such traits include health traits (lameness, mastitis, susceptibility to parasites and fly strike), meat quality, lamb vigour and feed intake traits. However, in order to include such traits within the genetic evaluations tools must be developed for each trait to allow for accurate data to be recorded.

The key to a sustainable and a profitable industry is direction. Teagasc are committed to developing a bio-economic model which will model individual farm systems thereby evaluating the relative economic importance of individual traits within typical Irish sheep farms. Not alone will this model generate relative emphases for individual traits in the Sheep Value Index but it will also help to prioritise research in the areas that are likely to have the greatest impact on sheep flock profit. Additionally, research will be undertaken where groups of animals segregated on genetic merit will be compared and their difference on profit compared to the expectation based on predicted genetic merit.

Genomic selection is a new tool which can increase the accuracy of identifying genetically elite animals. It is currently widely used within the Irish dairy population and will soon be implemented in

beef. Sheep can also benefit greatly from genomic selection, but the breeding objectives, genetic evaluations, breeding programmes and validation studies need to be first prioritised.

When buying a ram, make use of LambPlus information when it is available

Summary

In Ireland genetic evaluations will become an important tool for sheep farmers in making more informed breeding decisions and has the potential to increase profitability at farm level. Teagasc will continue to work closely with the industry to further enhance sheep breeding and ensure that the benefits are clearly realised at farm level.

Synchronising Ewes for Early Lamb Production

Michael Gottstein,

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Sheep are seasonal breeders – in ewes oestrus begins as day light hours start to decrease in the autumn. From a marketing point of view it is important that lamb of a consistent quality is available all year round. To achieve this, a proportion of the national flock needs to lamb in the December/January period to provide finished lambs from mid-March onwards.

While there are some breeds that will naturally commence oestrous cycles in July/early August (e.g. Ile de France & Dorset Horn) for the vast majority of the breed types in the Irish National Flock (including Suffolk crosses and other breeds) oestrus can be induced by using progestagen impregnated sponges. The use of sponges allows for oestrus to be synchronised and thereby allows the use of PMSG to be used to increase ovulation rates and ultimately the litter size of ewes successfully mated.

Early lamb production systems rely heavily on concentrate feed/brassica crops as the lambing and rearing phases of the production cycle take place outside of the normal grass growing season. To justify the costs it is essential that the lambs produced from this system meet the target outlined below.

Ewes should be at least six weeks weaned when sponged

Dose of PMSG

The recommended dose of PMSG is 500 to 700 iu per ewe.

Targets

- 70% of ewes sponged conceive & lamb down
- Litter size of 1.7 lambs per ewe lambed
- 90% of lambs sold by 16 weeks of age

The programme for synchronisation and mating is outlined in Table 1.

Table 1: Synchronisation and mating regimes for out of season mating of ewes

Procedure	Timeframe
Insert sponges	Day 0 AM
Remove sponges and	Day 12 AM
Inject PMSG (500- 750iu)	
Mating hogget ewes	Day 13 PM
Mating mature ewes	Day 14 AM
Remove rams	Day 16
Introduce rams for repeat mating	Day 28
Remove rams	Day 34
Scan ewes and return non-pregnant ewes to ram	Day 80

It is recommended that the ewe to ram ratio should not exceed 8:1

Important Points

- Use sound ewes (udder, feet, mouths and no history of prolapse)
- Ewes should be at least six weeks weaned when sponged
- Ewes targeted for sponging should be in BCS 3.5 to 4.0
- Rams must be fit, free from lameness and have not been subjected to elevated body temperature for the least eight weeks pre-mating
- Use a number of rams together (ideally 3+)
- Hogget ewes - introduce rams 36hours post-sponge removal
- Mature ewes - introduce rams 48hours post-sponge removal
- Order sponges and PMSG in advance – store PMSG in fridge until required.
- Insert sponges gently – special care should be taken with first time breeders – use lubricant
- Clean and disinfect sponge applicator between ewes
- Inject PMSG into the muscle at the time of sponge removal
- Use a mature ram to not more than eight ewes

Availability of Drugs

Both the progestagen sponge and PMSG are prescription only medicines (POM).

The Lowland BETTER Farm Sheep Programme: Messages To-Date

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There is great scope on many sheep farms to improve profitability by adopting relevant technology. However, for this to happen the sheep enterprise must be treated as a business. Furthermore, there must be a willingness to make the relevant changes needed to improve flock productivity and thereby the profitability of the sheep enterprise. The BETTER Farm Programme for sheep was established in 2008 to provide a forum where technologies developed from the sheep research programme at Athenry and elsewhere could be demonstrated and their benefits quantified on commercial farms. These farms were chosen to provide focal points for the on-farm implementation, development and evaluation of technologies that are relevant to the sheep sector. By doing this the farms and these farmers would be used as a resource to drive wider adoption of technologies in the sheep sector. The focus of this article is to outline some on the key changes made on the 4 lowland flocks in counties Donegal, Roscommon, Wicklow and Kerry currently involved in the in the BETTER Farm programme.

Prolificacy

In lowland systems the number of lambs weaned per hectare is a major determinant of flock profitability. This is a combination of the number of lambs weaned per ewe joined and stocking rate. The target set for each of the farms is to produce over 1.6 lambs reared per ewe joined which would place them in the top 10 % of flocks nationally. The number of lambs weaned per ewe joined is a combination of litter size, percent ewes lambed and total lamb survival. Of these litter size is the key trait as it sets the upper limit for the number of lambs reared per ewe joined. The progress to date on the farms is summarised in Table 1. At the start of the programme an inventory of ewe breed and age profile was recorded. A total of 3 to 6 ewe breed types were present on each farm. This would suggest that the replacements were largely a by product of the lamb crop as opposed to a product of a defined breeding policy. Clearly, this indicated the lack of emphasis placed on the choice of ewe breed which was evident in the moderate number of lambs weaned per ewe joined in the first year of the programme (Table 1.). Litter size, percentage of ewes lambed and lambs weaned per ewe joined have consistently increased in each of the three years.

Typically, in a flock the two-tooth ewes would amount to approximately 23% of the ewes available for breeding. Initially for the BETTER Farm flocks the level of replacements introduced to the flock varied from 11-25%. Part of the plan for these flocks was to produce all replacements using prolific,

predominantly Belclare, sires with the resultant progeny having the capacity to deliver litter size of 1.9 or greater.

Results to-date shows that high lamb performance can be achieved off grass.

Table 1: Average BETTER Farm lowland flock performance to date

	Year		
	1	**2**	**3**
Litter size	1.71	1.77	1.85
Percentage of ewes lambed	90.2	93.8	95.5
Lambs weaned per ewe joined	1.38	1.5	1.63

The number of ewes required to produce replacements depends on the flock productivity, the more prolific the flock the less ewes need to be mated with maternal rams. The percentage of ewes required to produce ewe replacements allowing for 5-10% of the ewe lambs produced to be discarded is presented in (Table 2).

Table 2: Influence of number lambs reared per ewe joined on the percentage of ewes required to produce replacements

Number of lambs reared per ewe joined	Percentage of ewes required to produce ewe replacements
1.1	46.4
1.3	39.2
1.5	34.0
1.7	30.0
1.9	26.8

Stocking Rate and Flock Size

The second component of lamb output per hectare is the number of lambs weaned per ewe joined. Stocking rate is particularly important where the land base is limited. At the start of the programme the four lowland BETTER Farm flocks sizes ranged from 60-330 ewes with stocking rates ranging from 7-10 ewes per hectare. The potential stocking rate on a farm will depend on the level of management, land quality and facilities available. The objective on these farms was to increase flock size and thereby stocking rate. By the end of Year 3 the stocking rate on the farms will be between 10-13 ewes per hectare.

Grassland Management

Grazed grass represents the cheapest source of feed in a sheep system. However, on most sheep farms it is not exploited to its full potential. One of the initial observations on the BETTER Farms was the lack of grass availability at turnout in spring. This was largely as a result of the lack of a winter management policy with fields grazed into early January on some farms and with others fields not closed. For each farm a schedule of closing of fields starting in autumn was agreed to ensure sufficient grass was available in spring. An example of the impact of this along with addressing soil fertility problems that may have been present has had on grass availability on one of the farms is presented in Figure 1. On another farm where there was insufficient housing for all the flock and an extended grazing plan was agreed and operated for stock that met their dietary demands.

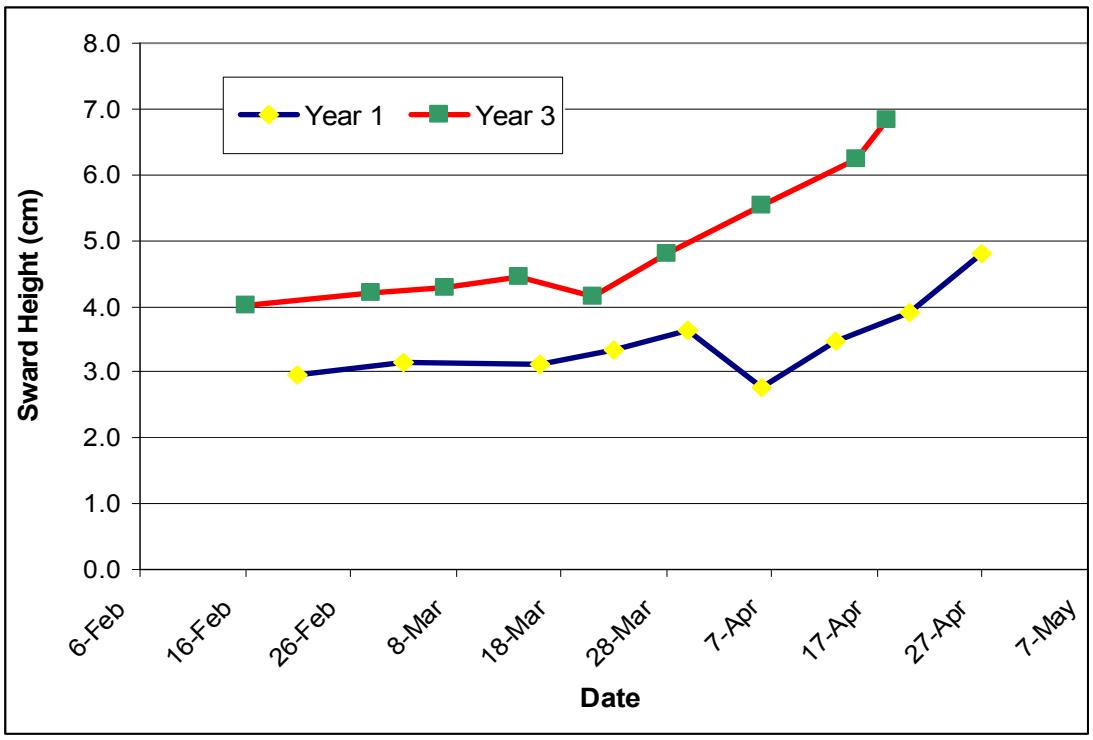

Figure 1. Average sward height following turnout on the 1st and 3rd year of the programme

For some of the farms over reliance on concentrate feed to finish lambs was negatively impacting on the overall profitability of the system. The aim for the farms is to maximise the performance of lambs from a grass only diet. By the third year of the programme three of the four farms have ceased feeding concentrates to lambs at grass (excluding triplets and those from yearlings ewes) whilst the fourth farm is limiting the amount of supplementation used.

Division of Fields

One of the changes made on the farms to facilitate good grassland management was the division of fields into manageable grazing areas. On some of the farms field sizes were as large as 8 ha which was not conducive to effective rotational grazing and management of grass. The smaller field sizes and increased number of paddocks allows for efficient grassland management. Additionally, where supply exceeds demand the extra paddocks allow the farmers to remove them for silage production, thus maintaining grass quality in the grazing system.

John Curley inspecting his ewe flock in Co. Roscommon Note the use of electric fence to control the grazing

Post Weaning Lambs Performance

One area of concern was the level of lamb performance post weaning, with growth rates of 100 to 120g/day being recorded on a number the farms whilst others were achieving >170 g/day. This is well below the 200 plus g/day target being achieved in the flocks in Athenry. Clearly, there is potential to improve lamb performance during the post weaning period, this will be a continued focus of efforts on these farms.

Gastrointestinal Parasite Control

The control of gastrointestinal parasites in the Irish sheep flock is largely dependent on effective anthelmintic treatment. Each of the farms treats lambs for nematodirus at five to six weeks of age with either a levamisole of a bendzimadazole based product. From 10 weeks of age onwards faecal samples

are collected for faecal egg counts using FECPAK analysis. This period coincides with increased parasite challenge (*Teladorsagia* and *Trichostrongylus* spp.), which have negative impacts on lamb performance. Lambs are treated based on the faecal egg counts analysis. A serious issue facing sheep farmers is anthelmintic resistance. The farms involved in this programme have exhibited resistance to both bendzimadazole and levamisole based products (Table 3).

Table 3: Incidence of resistance to anthelmintics on three of the farms

	Product group		
	Macrocylic lactone	**Levamisole**	**Bendzimadazole**
Farm 1	No	No	Yes
Farm 2	No	Yes	Yes
Farm 3	No	Yes	Yes

Continuing dosing with ineffective products represents a cost both in terms of possible reduced lamb performance and product cost.

Key Messages To-Date

- Ewe productivity is the key to flock profitability. There is a need for defined and consistently applied policy to produce quality prolific replacements.
- There is significant potential to increase stocking rate while simultaneously maintaining and or improving the level of lamb performance.
- Good grassland management can result in high levels of lamb performance in the absence of concentrate supplementation.
- Anthelmintic resistance has been identified on the BETTER farms and it is likely to be an issue on many sheep farms throughout the country. Need to establish the anthelmintic status of your farm.

Management of the Hill Sheep Flock at Leenane with Special Reference to Lambing Supervision

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The purpose of this paper is to outline the performance of the ewe flock at the Teagasc Hill Farm with particular emphasis on management inputs around mating and lambing as an example of the performance that can be achieved in terms of ewe and lamb survival without round-the-clock supervision during the lambing season.

Farm Facilities and Production System

The Teagasc Hill Sheep Farm was located in the Sheffry hills near Leenane and consisted of 250 ha of hill land and 20 ha of reclaimed green land. The farm varied in altitude from 15-275 metres above sea level and average rainfall at the farm was 2081mm for the 10 years 2000 to 2010. The green-land area was re-seeded in 1991/92 and the swards were mainly ryegrass; it was possible to cut silage from about half this area.

There was a stock-proof perimeter fence and the green land was fenced into 10 paddocks – mostly sheep wire but has electric fence around the main lambing paddocks. There was a slatted sheep shed which accommodated 200 ewes. The handling facility was built alongside a three-bay hayshed with the race and weighing scales under the shed roof; the hayshed also provided storage for farm equipment There was also a small tractor, trailer and transport box, livestock trailer and block cutter on the farm. The flock consisted of around 280 Scottish Blackface (local type) ewes, 40 crossbred ewes and about 75 homebred replacements. The ewes were managed as two integrated systems:

Hill System (200 purebred ewes) - ewes spent about 70% of the year on the hill and had use of 5.6 ha of green land for mating, lambing and for ewes with single males to weaning. Wether lambs were sold to export market for light lamb – some were finished indoors; and ,

Lowland System (120 ewes) – ewes spent about 30% of the year on the hill and had use of 14.4 ha of green land for mating and from lambing to weaning. Lambs remain on green land until sale or indoors for finishing from early October.

The replacements ewes were housed and fed silage, and supplemented with concentrates from mid November to late April and spent the rest of the year on the hill. The ewes in the Hill system were bred pure (to generate flock replacements), while the ewes in the Lowland system were crossed (usually

with Belclare rams) to produce prolific ewe replacements for sale. Purebred ewes spent their first three breeding seasons in the hill system and usually were then transferred to the Lowland system where they remained until they had to be culled. Ewes were checked for breeding soundness (teeth, udder, feet) at weaning and those that were to be culled were identified; cull ewes were sold at an appropriate stage between weaning and late September. Broken mouth was the principal culling reason.

Management of Ewe Flocks

All ewes were on the hill grazing from weaning until just before joining with rams – with the exception of a small number of ewes in poor condition that were removed from the hill earlier. Between weaning and mating the green land was grazed by the lamb crop. Crossbred wether lambs were sold to slaughter at French market weights; purebred hill wethers went to the light lamb market; crossbred females were sold off the farm in early September. In early October, remaining lambs were housed (for finishing) to ensure that sufficient grass was available for the mating period. The mating system involves single ram groups for both Hill (5 rams) and Lowland (5 rams) systems so that sire and dam were known for every lamb. Ewes were put to ram in late October for the Lowland system and in the third week of November for the Hill system. The joining period was 35 days in both cases; rams were fitted with crayons and ewes mated within the first 10 days get a permanent colour mark to facilitate introduction to concentrate feed 10 days before the remainder of the flock and so that they can be put out to grass before the rest of the flock (Lowland system) - thus making best use of the scarce grass supply at lambing time. The paddocks on the green land area were used for mating and when rams were removed all ewes were put to the hill until early January (Lowland system) or early February (Hill system). The management of the two flocks differed from this point until lambing. Only ewes from the Low Flock were scanned in mid-pregnancy to identify twin-bearing ewes. Because of the small number of twin bearing ewes in the Hill Flock it was felt that the cost of scanning was not justified in terms of the amount of supplementary feed saved.

***Lowland flock**:* Ewes bearing twins(about 50%) in the Lowland flock were housed in a slatted shed in January and offered silage *ad libitum* and were separated into early and late lambing groups; ewes were offered a proprietary ewe-and-lamb ration (18% crude protein) starting at 230g per day at week six prior to the expected lambing date. The allowance was gradually increased to 560g per day before lambing. The remainder of the ewes were returned to the hill and were inspected every two to three weeks and any thin ewes from both flocks (condition score two or less) were drafted to the shed and separated into early and late groups and got 230g of concentrates per day at week five increasing to 450g per day for the final week before lambing. Ewes were put to pasture just prior to their expected lambing date (based on early or late mating). Concentrate supplementation was continued outdoors

depending on grass supply on a flock basis, using the daily allowance for singles. Ewes were drafted from the lambing paddock as they lamb and get no further concentrate.

Hill flock: When the sheep house was full any remaining ewes from the Hill Flock were drafted onto an enclosed area of the hill (4ha) and offered concentrates – starting at 230g per ewe per day and increasing gradually to 454g at three weeks prior to onset of lambing. Ewes drafted for supplementary feeding remain in the enclosed hill paddock until they lamb. About 50% of the Hill flock ewes were off the hill by the third week of March the remainder stay on the hill until just prior to lambing when they were moved onto a paddock in the green land area for lambing and got concentrates (450g/day) until they lambed. All ewes were drafted from the lambing areas as they lambed. Ewes with twins or male singles were drafted to the same paddock while ewes with female singles were drafted to a separate paddock.

Supplementation started at 230g per ewe per day and increased gradually to 454g at three weeks prior to onset of lambing

Lambing Supervision

From the onset of lambing the first daily inspection was at 6:30 AM - this was the most important inspection of the day as any problems that had arisen during the night were identified. Newborn lambs that had bonded with their dam and were suckling satisfactorily were drafted, during late morning, to a nearby yard area. Immediately before entering the yard, lambs' navels were sprayed with iodine solution, then they were tagged, weighed and sexed, the mother's tag number was also recorded along with her condition score and weight. All dead born lambs were weighed and details recorded. Udders were checked carefully for sufficient milk supply and mastitis before moving animals to the grazing paddock. Ewes were checked hourly during the day until around 4.30 PM; checking was done again

between 6.30 PM and 9 PM, depending on daylight. There was nobody on the farm between the last check and 6.30 AM. Our records show that 40% of lambs were born during this period.

Ewe Performance

Details on the performance of the two systems are summarised in Table 1, for the 3 years to 2010. The proportion of ewes that lambed was higher for the Hill flock than the Lowland flock and the overall value was 91%. This was considered reasonably satisfactory given that single-sire mating groups were used (mostly ram lambs in the Lowland flock) and joining was limited to 35 days. A figure around 95% would be expected under conventional mating conditions.

Table 1: Summary of Ewe Performance for 2008 to 2010

	Hill system	Lowland system
Ewe live weight (kg)	41.1	48.4
Percent ewes lambed	92	89
Litter size	1.05	1.51
Lambs reared per ewe to ram	0.93	1.28
Lamb mortality (total) (%)	3.4	5.1
Annual ewe mortality (%)	4.5	3.1

Scottish Blackface ewe with her Belclare cross lambs

Lamb survival was good; the mortality shown in Table 1 includes all dead-born lambs and any that die between birth and weaning. About two-thirds of all lamb losses were classified as peri-natal (i.e.,either born dead or died within 24h of birth). The peri-natal mortality was about 3% in both flocks. Annual ewe mortality was greater in the Hill flock. Ewe and lamb mortality were both well below the national figures for lowland or hill farms.

Distribution of Lambing

The spread of lambing over the lambing season is a key indicator of the labour required as supervision will be needed regardless of the number of ewes lambing on any given day. The pattern of lambing is shown in Figure 1 for the last three seasons – day 1 represents the first lambing day in each year. Because the Hill flock was put to the ram three weeks after the Lowland flock the total lambing season lasts for 42 to 45 days. The last few ewes in the Hill flock lambed during the first week of May.

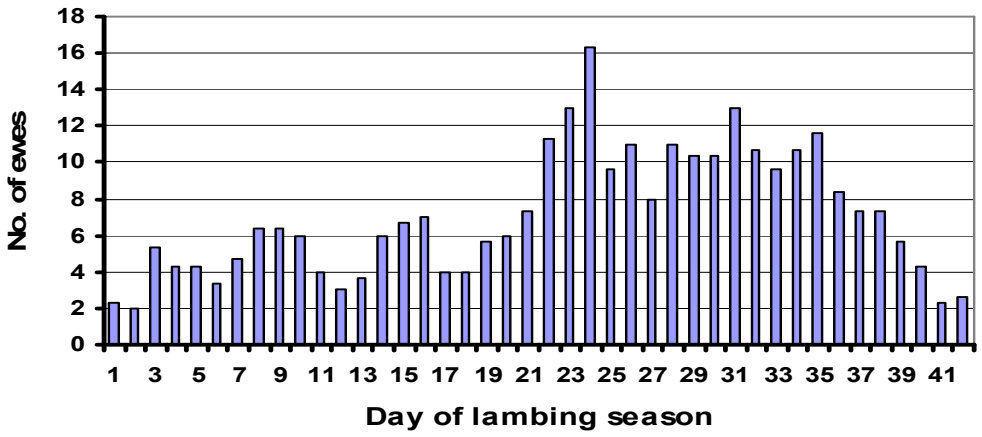

Figure 1. The actual daily incidence of lambing at Leenane – combined data for 2008 to 2010

In order to combine the information from both Hill and Lowland flocks to get the lambing pattern that would occur if all ewes were put to the ram on the same day the lambing date was expressed as the number of days relative to the mean date for each flock. The combined information gave the pattern shown in Figure 2. This shows that just over 92% of the ewes lambed within a 20-day period – a very compact lambing pattern. This pattern means that during the 20-day period 4% to 5% of the ewes would lamb each day – i.e. 8 to 10 ewes per day for a 200 ewe flock. This was about the number that lamb at Leenane under the mating programme for a 320 ewe flock. If all ewes at Leenane were put to the ram at the same time the number lambing per day would be around 14 to 17 ewes – this could have been be managed without any difficulty given the present facilities at the farm.

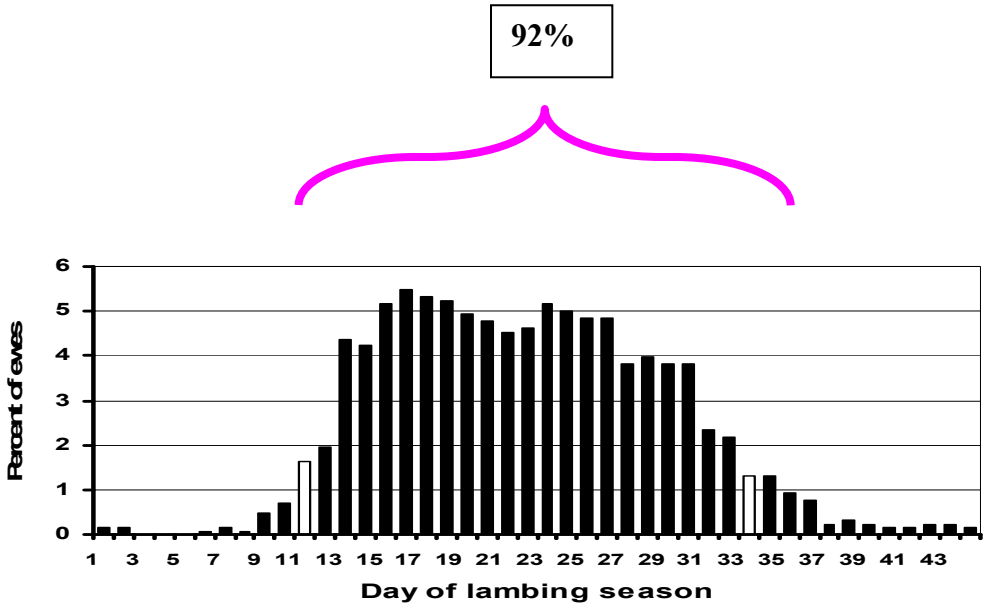

Figure 2. Expected pattern of lambing at Leenane if all ewes were put to ram at the same date – 92% of ewes lamb between day 12 and day 33, inclusive

Summary

- These results show what can be achieved on a farm that was well organised in terms of fencing and handling facilities and has a well defined annual management programme and with only the essential farm equipment for a sheep system.
- Total lamb mortality can be kept well below 10% for flocks lambed outdoors on lowland without any supervision during the hours of darkness – in the present case this represents the hours between 9 PM and 6.30 AM – and with a break between 4.30 and 6.30 PM.
- The high lamb survival recorded at Leenane was achieved despite the very high rainfall at that location and the exposed nature of the site.
- The Lowland flock was achieving an output of 1.28 lambs reared per ewe to the ram, which was equal to the performance for lowland flocks in the National Farm Survey. Thus, it can be argued that the performance of the Lowland flock in this study was a relevant and achievable target for well managed lowland flocks. However, the fact that ewes were lambed outdoors was probably a factor in the excellent level of survival being achieved in that it facilitated the expression of natural mothering instincts, which may be inhibited somewhat under crowded indoor lambing conditions.
- It is also suggested that even if all ewes were put to the ram on the same day one operator could manage the lambing as over 90% of the ewes would lamb within a 21-day period.
- Our results show that intensive night-time supervision is not essential; thus one of the periods seen as the major burden in flock management can be rationalised without prejudice to good animal survival - at least under the conditions that obtain at Leenane.

The Hill BETTER Farm Sheep Programme: Messages To-Date

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In hill flocks the potential to improve output is often more limited than on lowland farms given the environmental constraints within which they operate. Nevertheless significant capacity to improve these systems exists. Currently, there are three hill flocks involved in the BETTER Farm Programme in counties Donegal, Sligo and Mayo. Each of these farms is working on a programme to improve output and profitability from their hill sheep enterprises. This article will highlight a number of the key issues and changes on the farms.

Flock Size and Replacement Policy

On hill farms changing flock size is often not an option, particularly on farms which include access to commonage. Furthermore, the capacity of many hills to provide additional feed resources during the winter period is limited thus hindering flock expansion. Within these constraints a plan was developed for each of the 3 hill farms to maximise the number of breeding ewes allowing for sufficient replacements. Similar to the Lowland Flocks in the BETTER Farm Programme, an inconsistent replacement policy was also evident on the hill farms at the start of the project. This was probably the result of factors; sales of potential female replacements in response to good market conditions, insufficient ewes mated with purebred rams etc. The consequence of this is a highly unstable production pattern which over the course of a few years will ultimately impact flock profitability. For a hill flock a target annual replacement rate is generally slightly higher than in a lowland flock as a result of higher culling practices and higher natural wastage. A replacement rate of 24% is generally sufficient to maintain a stable flock size and structure. This was the basis for a breeding plan in the hill flocks. The number of ewes required to meet this target is influenced by flock prolificacy and this is shown in Table 1. Having provided for flock replacements an opportunity was identified to increase the output from the flock by producing crossbred lambs that can be used either for slaughter/store trade or as prolific replacement females for the lowland sector. This was an area that was not being exploited to its potential within these flocks.

Importance of Ewe Weight

Improvements in ewe weight and body condition score at joining is known to improve the potential litter size and will also have beneficial effects on the proportion lambing. This is especially true for

Scottish Blackface ewes which are particularly responsive to improvements in body weight at joining, more so than in lowland breeds as outlined in (Figure 1).

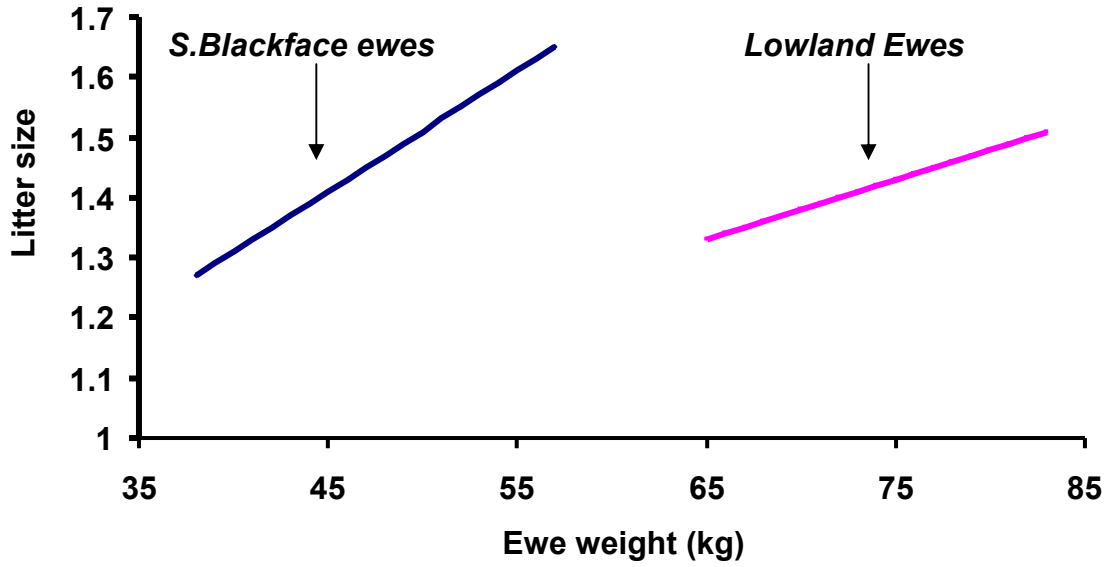

Figure 1. Relationship between ewe liveweight at joining and subsequent litter size for Scottish.Blackface and Lowland ewes

Improving ewe weight and body condition score at mating will improve litter size and the proportion lambing the following spring

As a breed substitution is not a viable option, hill flocks have to rely solely on improvements in weight and condition to increase litter size. The three hill flocks involved in the BETTER Farm programme have enclosed areas of semi-improved grazing. There is potential to use these areas strategically to build up a reserve of feed during the early autumn period, which can be used to improve ewe weight and condition at joining. This will improve both ewe prolificacy and the proportion of ewes lambing the following spring, consequently the potential to produce more cross bred lambs. An increase in litter size of 0.2 would allow for 12% more ewes to be joined with crossing rams.

Table 1: Influence of number lambs reared per ewe joined on the percentage of ewes required to produce purebred replacements - Hill Flocks

Number of lambs reared per ewe joined	Percentage of ewes required
	For pure breeding
0.8	68.8
0.85	64.7
0.9	61.1
0.95	57.9
1.0	55.0

Increased ewe output is a prerequisite to improve profitability from Hill Flocks

Ram Management at Mating

Another issue that was highlighted on the BETTER Farms was problems surrounding the management of rams during the mating period. These included problems of ram infertility, and or sub-fertility. The risk of ewes being mated by a sub-fertile/infertile ram can be minimised by exposing them to more

than one ram during the mating period. If using single-sire mating (i.e., an individual ram with a batch of ewes) is practiced it should only be continued for a limited period (e.g., 17 days or so), after which group mating should be used. Similar problems can occur where group mating is used and where the dominant ram is sub-fertile or infertile. Having rams raddled during the mating period and changing colours at appropriate intervals to provide early warning of potential fertility problems is highly recommended.

Increased Productivity To-Date

By taking a proactive approach to the management of the flock prior to, and during the mating period, benefits for the three hill flocks involved in the programme have begun to emerge (Table 2). The target for these flocks is to increase the number of lambs weaned per ewe joined to over 1, and achieve this on an annual basis.

Table 2: Ewe Performance in BETTER Farm Hill Flocks

	Year		
	1	**2**	**3**
Litter size	1.18	1.29	1.32
Percentage of ewes lambed	88.2	79.5	95.9
Lambs weaned per ewe joined	0.96	0.92	1.10

Key Messages To-Date

- Increased ewe output is a prerequisite to improve profitability from Hill flocks
- There is potential to increase lambs weaned per ewe joined to be above 1.0
- Improving ewe weight at joining impacts on both subsequent litter size and the proportion of ewes lambed
- Management of rams at mating should avoid over-reliance on single sire mating

Increasing lambs weaned per ewe joined can potentially increasing the proportion of crossbred lambs produced – hence output per ewe.

Electronic Identification (EID) of Sheep

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Electronic identification (tagging) is now a requirement on sheep farms. For the majority of farmers the issues are straightforward. Only tags that have been approved for use under the NSIS may be used. (An Electronic Identification set, (EID set) refers to a pair of tags, one being a conventional mart tag for the left ear and one being an EID tag for the right ear).

A sample of an electronic ear tags available for sheep

Main Elements of the National Sheep Identification System

If you are a keeper of sheep you are required by law to:

- Register with DAFM and obtain a holding (flock or herd keeper) number;
- Identify all animals before they leave your holding or before they reach nine months of age, whichever is the earlier;
- Identify all lambs intended for slaughter at the holding of origin and ensure that they retain this one tag number for their life from the holding of origin. These lambs cannot be retagged when moving from one holding to another;
- Ensure that all new sheep (born or first identified after 31 December 2009) **and which are being kept for breeding or being exported live** are tagged with two identifiers bearing the same number, one of which must carry an electronic device. Where boluses are being used, a matching blue tag must be applied at the same time as each bolus;

- Obtain a book of movement or dispatch documents customized for your holding;
- Complete your own movement or dispatch document when animals are moved off your holding;
- Maintain an up-to-date holding or flock register;
- Complete and return an annual sheep census inventory to the Department of Agriculture, Food and the Marine; and ,
- Notify movements of sheep purchased onto your farm directly from another farm (not through a mart) to you local District Veterinary Office.

There is no evidence from Teagasc studies that tagging of lambs at birth results in an increased incidence of infection of the ear or subsequent drooped ears

What is Required ?

The identification requirements for sheep, as outlined here apply to sheep born after 1 January 2010. **Farmers should be aware that the older animals born before 31 December 2009 do not have to be electronically tagged and can continue to be tagged under the old arrangements.**

In general, the identification requirements for sheep born after 1 January 2010 are a follows:

1. All sheep must be tagged with at least one tag by 9 months of age or on leaving the holding of birth, which ever comes first;
2. All sheep, born in 2010 or later, and being retained beyond 12 months of age must be double tagged with an EID set;
3. **Sheep intended for slaughter, and going directly to a slaughter premises:** If these are to be sold before 12 months of age, they may be tagged in just the left ear with a conventional slaughter tag also referred to as a **temporary tag**. There is no need for electronic tagging;
4. **Sheep going for sale via a mart or directly to another farm:** If these are sold before 12 months of age they may be tagged in the left ear with a conventional tag which must be approved as a **mart tag**;
5. **Animals being kept for breeding:** These must be double tagged by 9 months of age with a conventional mart tag in the left ear and an electronic tag in the right ear. Both tags will have an identical 12 digit tag number. Both tags will be yellow. (An alternative option to the electronic tag is to fit animals with a bolus in the rumen. The tag fitted on the left ear of a sheep with a ruminal bolus will be light blue in color); and ,
6. **Animals bought in, to be kept on the farm for breeding.** Animals less than 12 months old bought at marts or directly from another farm, and tagged with one conventional mart tag must be upgraded to double tagging with an EID tag if they are to be retained for breeding. This must be done by the time the animal is 12 months of age. There are two options for upgrading (see note below re: upgrading).

Only tags that have been approved for use under the NSIS may be used

7. **Tagging of Store Lambs**
    - **Animals bought in, having one conventional mart tag from the holding of origin to be kept on the farm for feeding & destined for slaughter before they are 12 months**

old. Since May 2011 animals in this category cannot be re-tagged and must retain the tag of origin. They then must be listed on your dispatch document as they leave your farm.

- **Recommended optional electronic tagging -** Flock owners selling store lambs or lambs that are likely to be bought for fattening before being slaughtered are recommended to electronically identify their lambs. There are two options. Lambs can be tagged in the right ear with a **single EID tag** (instead of a permanent mart tag) when tagging the lambs on leaving the holding. Sheep identified with such an EID tag should be more attractive to fattener producers who buy in sheep from multiple holdings. A store lamb finisher can then invest in some reading equipment which would automatically generate the tag list after the sheep are scanned. Alternatively, these lambs could be tagged with an EID set

8. **Animals bought in already tagged with an EID set.** No further tagging of these animals required.
9. **Live Export:** Sheep born after 1 January 2010 and exported live to another country, including to Northern Ireland for slaughter, must be double tagged with a conventional mart tag in the left ear, and either an electronic tag in the right ear or a ruminal bolus. Sheep purchased for export but not identified as above can be upgraded to EID status (see below). Sheep born prior to 1 January 2010 that have already been double tagged with a matching set of conventional tags do not have to be retagged.

For lambs being sold before they reach 12 months of age, the farmer may opt to use a single electronic tag in the right ear

Upgrading to EID Status

There are two choices.

1. A custom made EID tag, bearing the same number as the conventional mart tag already on the animal can be ordered. This will then be put on the right ear of the animal.

2. The more convenient system is that the sheep can be re-tagged with a new EID set from your own stock of tag sets, and the new tag number correlated to the old number in the flock register. The remaining tag can be left in or removed unless the animal is being exported in which case it must be left in. If the remaining tag is electronic it must be removed in all cases.

EID combined with electronic data loggers will greatly facilitate data recording in sheep flocks

Lost Tags

Where a single tag has been lost, a custom made tag can be ordered to replace the lost tag and bearing the same number as the one remaining tag on the animal. Alternatively, the sheep can be re-tagged with a standard new EID set. (If you opt to re-tag with a new set and the remaining tag is the electronic tag, it must be removed) This is acceptable if the animal was born on your own farm. It is also acceptable for bought in animals, if the old number is known. The new tag number can then be correlated to the old number in the flock register. If the old number is not known and you do not know the farm of origin of the animal, a special set of tags, red in color, must be ordered from your tag supplier. Animals bearing these red tags may remain on your farm as long as you wish. (According to current rules, when they are finally sold they may only be sold through a slaughter abattoir. However, this rule may be changed allowing you sell these sheep wherever suits you).

This article was compiled following considerable consultation with Mr Dave Caldwell and Mr Noel Holleran, Department of Agriculture, Food and the Marine.