Animal & Grassland Research and Innovation Programme

Teagasc

National Sheep Conferences 2020

Tuesday | 28th January 2020
Great Southern Hotel, Killarney, Co. Kerry

Thursday | 30th January 2020
Springhill Court Hotel, Kilkenny, Co. Kilkenny

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Agriculture and Food Development Authority

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Teagasc National Sheep Conference 2020

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Thursday 30th January 2020

Compiled and Edited by Michael G Diskin,
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Mellows Campus, Athenry, Co. Galway.

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Teagasc National Sheep Conference 2020

Venue: **Great Southern Hotel, Killarney, Co. Kerry.**

Date: **Tuesday, 28th January 2020.**

Conference Outline

Chairperson: *Kevin O'Sullivan, ASSAP Advisor, Killarney, Co. Kerry.*

18.00 **Conference Opening**
Michael G. Diskin
Sheep Enterprise Leader, Athenry, Co. Galway.

18:10 **Efficient nutrient use - meeting production and environmental targets on sheep farms.**
David Wall
Teagasc, Crops, Environment & Land Use Programme, Johnstown Castle, Co. Wexford.

18.40 **Commercial data – how it benefits our breeding indexes**
Nóirín McHugh, Fiona McGovern, Eamon Wall, Kevin McDermott and Thierry Pabiou
Teagasc, Animal & Grassland Research and Innovation Centre, Moorepark & Athenry and Sheep Ireland, Highfield House, Shinagh, Bandon, Co. Cork

19.10 **Anthelmintic resistance in stomach and gut worms of sheep.**
Orla M. Keane
Teagasc, Animal & Bioscience Research Dept, Grange, Dunsany, Co. Meath, Ireland.

19.40 **Growing my farm; the challenges and progress to-date.**
John O' Connell, Tom Coll, Jonathan Molloy, Ciaran Lynch, & Frank Campion.
Teagasc BETTER Sheep Farmer, Cloverhill, Ballinamore, Co. Leitrim and Teagasc Mohill, Co. Leitrim, Teagasc, Athenry and Teagasc Ballyhaise.

20:10 **Close Conference**
Michael Gottstein
Sheep Specialist, Teagasc, Macroom, Co. Cork.

20:20 Tea/Coffee, Sandwiches & finger food served.

Organising Committee: Teagasc Sheep Programme Team

Teagasc National Sheep Conference 2020

Venue: **Springhill Court Hotel, Kilkenny, Co. Kilkenny.**

Date: **Thursday 30th January 2020**

Conference Outline

Chairperson: *Siobhan Kavanagh, Regional Manager, Waterford /Kilkenny Advisory Region.*

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Frank O'Mara,
Director of Research, Teagasc, Oak Park, Carlow.

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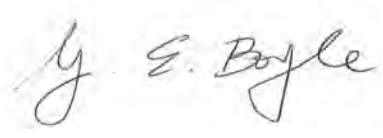
Foreword

The latest published sheep census statistics (Dec 2018) shows that there were 35,186 flocks in Ireland, a decrease of 536 or 1.5% from 2017. The 2.56 million breeding ewes produce a high quality product of which about 81% is exported. In 2019 almost 2.783 million sheep were processed in Irish lamb processing plants a decrease of 7% on 2018 figures. Sheep production is a significant contributor to the agricultural and national economy producing 67,415 tonnes of sheep meat valued at ~ €390 million. A total of 54,809 tonnes of sheep meat, valued at €300 million was exported. Over the past decade we have witnessed greater market diversification, with over 40% of sheep meat shipments, by volume, destined for markets other than the traditional French and UK markets in 2019. A total of 17,912 tonnes (-7%) and 15, 691 tonnes (+4%) went to France and the UK in 2019, respectively. Diversified, high value markets such as Belgium, Germany, Sweden, Canada and Italy are now becoming significant destinations for Irish sheep meat. China is becoming a major importer of sheep meat. A total of six Irish shipment processing plants are eligible to export to China and hopefully China will become a realistic market in 2020. Cumulatively, there are some grounds for a modest optimism for the Irish sheep industry in 2020 notwithstanding that the final Brexit deal has yet to be completed and Ireland is very dependent on the UK market.

The Teagasc 2018 National Farm Survey results show an average gross margin of €640 per hectare for lowland mid-season lambing flocks. This represents a reduction in gross margin compared with previous years largely reflecting the difficult spring and drought during the summer of 2018 and the associated increased feed and fertilizer used on farms. However, the top one third of flocks generated a gross margin of €1,184/ha compared to €180/ha for the bottom one third of flocks. Due to higher weaning (1.43 vs 1.17 lambs per ewe) and stocking rates (9.74 v 6.10 ewes/ha), output on the Top farms (€1,752/ha) was more than double the output of the Bottom farms (€744/ha) and total direct costs were only marginally higher (€569/ha vs €564/ha) despite the significantly higher output. Most interestingly, the cost of concentrates used, expressed on a per hectare basis, was similar for Top (€264/ha) and Bottom (€260/ha) flocks. Gross margin per hectare is more than six times higher on the Top farms compared to the Bottom. This indicates that there is significant scope to increase income by improving technical efficiency on many farms.

Technical performance in terms of ewe productivity, grassland management, stocking rate and flock health are all important drivers of profitability and must be the sustained focus of all sheep producers. This is the clear message from Teagasc to the Sheep Industry and it is very much the focus of this conference. There is significant scope to increase grass production and utilisation on sheep farms. Key to this is optimising soil pH and phosphorus and potassium status combined with nitrogen use particularly for early grass. These are key messages from the papers of David Wall and John O'Connell. Since the establishment of Sheep Ireland, the production of genetic indices for sheep has advanced significantly. Incorporating more data from commercial flocks will further improve the accuracy and relevance of these indices particularly for commercial sheep producers and is the focus of Noirin McHugh's presentation. Worm infections in the gut of grazing lambs have a negative impact on the animal's performance. Resistance to benzimidazole (1-BZ: white wormer), levamisole (2-LV: yellow wormer) and macrocyclic lactone (3-ML: clear wormers) has now been identified on Irish sheep farms and is now a serious threat to lamb production. Orla Keane outlines practical cost-effective steps all lamb producers can take immediately to slow the development of anthelmintic resistance and prolong the efficacy of the drugs.

Over the years significant amounts of new information is presented at the Teagasc National Sheep Conferences and this year is no different. Continuous generation of new information is critically important and the incorporation and application of this information into on-farm production systems must be the on-going aim of sheep farmers. There are a number of important take home messages from each of the papers. Farmers should focus on implementing a number of these technologies on their farms. This is now the 8th year of the Teagasc National Sheep Conferences and they play a very important role in technology transfer to the sheep industry. This booklet collates and summarises a significant body of new knowledge on technical issues in sheep production and should prove an invaluable reference to sheep producers. I would like to thank all the speakers, the Teagasc organising committee and local Teagasc advisory staff.



Director, Teagasc.

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Efficient nutrient use - meeting production and environmental targets on sheep farms.

David Wall
Crops, Environment & Land Use Programme, Teagasc, Johnstown Castle Environment Research Centre, Co. Wexford.

Take home messages

- Improved efficiency of nitrogen (N) inputs on all farms is critical for achieving both production and environmental targets.
- Higher nutrient use efficiency (NUE) is linked with increased profitability, however, the adoption of suitable nutrient management practices are required to achieve reductions in gaseous emissions and improvements in water quality across Ireland.
- Low soil fertility (i.e. pH, 6.3 or P and K at Index 1) equates to a loss in grass production of at least 1.5 t dry matter /ha per year which is worth at least €160/ha per year on a sheep farm.
- Correcting soil pH through lime applications is the first critical step towards building soil fertility, increasing grass production and increasing sustainability on the farm.
- Protected urea grows the same amount of grass as CAN while being very cost competitive
- Low emissions slurry spreaders can deliver 3 extra units of N per 1,000 gal slurry with reduced grass contamination compared to splash-plate applications.
- The incorporation of white clover into grassland swards coupled with good soil fertility, the use of protected urea fertiliser and low emissions slurry application methods can further enhance the NUE and sustainability of sheep farming systems.

Introduction

Grass-based sheep production systems provide opportunities for farmers to achieve productive, profitable and sustainable farming across Ireland. Increasing the proportion of grazed grass reduces production costs and can increase profitability in sheep production systems. Nitrogen (N) and other nutrient inputs to promote grass growth and quality are of fundamental importance to the success of these systems. However, there are many intermediary processes that grass goes through before it is turned into a saleable product (e.g. lamb), which provides the financial return; by this time the link between the financial investment in fertiliser is less clear. This is mainly because a significant proportion of the nutrient, in particular N, taken up by the grass and consumed by the grazing sheep flock (60-90%) is excreted back to the soil/grassland, particularly in the urine. While sheep are better at distributing their dung and urine compared to cattle at grazing, urine patches in fields lead to the uneven application of N in concentrated patches, which can lead to increased N losses from the soil. This leads to poor overall recovery of N inputs and poses challenges for the environment.

Why is efficient nitrogen use important?

More efficient use of nutrients, including N, has a significant effect on a farmers bottom line. Fertiliser costs can be up to 25% of total input costs on the farm and where fertiliser nutrients are not being recovered by the grass or by the sheep and, or cattle and turned into saleable products (i.e. milk and, or meat) this represents a financial loss to the farming system. Increasing N efficiency by improving utilisation of N by grass will result in lower losses of N to the air and water. If a farmer can get more production (grass, meat, milk etc.) for the same quantity of N input, or get similar production using less N input it will lead to higher levels of nutrient efficiency, and potentially offset the need for purchase expensive additional feeds or to help increase the total production from each hectare. Therefore N fertiliser planning should not just consider the seasonal grass feed demands of the flock, or herd, but also the potential of the different soils/fields and swards to utilise applied N inputs over the season for grass production.

Environmental targets for agriculture

Agricultural N management remains a key environmental challenge and has implications for water quality, greenhouse gas emissions and ammonia gas emissions. Improving N management is a matter of urgency to reduce the serious ecological consequences of the reactive N. Improving water quality in Ireland, in particular reducing the eutrophication in lakes, rivers and coasts, remains one of the key environmental challenges. Among the substances responsible for eutrophication, nitrate (NO_3-N) leaching from agricultural soils is an important contributor. Agriculture accounts for approximately 33% of Irish greenhouse gas (GHG) emissions with most of the remainder being contributed by the transport and domestic sectors. Ireland is committed to reduce GHG emissions by 2030 and agriculture has been tasked to achieve a 10-15% reduction, relative to pre – National Development Plan 2030 projections (National Climate Action Plan 2019). Nitrous Oxide (N_2O) a potent GHG which originates mainly from organic and chemical N fertilisers and excreted N inputs to soils, accounts for almost 1/3 of agricultural emissions. Ammonia (NH_3) volatilisation reduces N use efficiency in agricultural production systems, contributes to indirect N_2O emissions and is also related to deterioration of regional air quality, and eutrophication and acidification of natural ecosystems. As a result, a number of European countries, including Ireland, have set annual emissions ceilings for NH_3 (National Emissions Ceiling Directive S.I. No. 10/2004: NECD). In Ireland ammonia emissions must be reduced by 5% by 2030 based on emissions levels in 2005. Meeting these ceiling obligations presents a challenge for Irish agriculture, which accounts for 98% of Ireland national NH_3 emissions.

As a result agriculture will need to play its part along with other sectors such as transport and energy to meet the national commitments our government has agreed to at an EU level. Adhering to these targets will require a new focus on improving the efficiency of how we use N on our farms. A number of management practices have been proposed to help agriculture meet its water quality and gaseous emission targets, however, the overall objective of many of these practices which relate directly to grassland soils and increasing overall NUE and the recovery of high proportion of N inputs during grass growth leading to lower overall N loss to the environment.

How do we measure the efficiency of N inputs?

The efficiency of N use can be defined as the efficiency in which N inputs are turned into saleable end-products on the farm including meat and grass (incl. silage and hay). A farm-gate N balance is useful to account for the main N flows at the whole farm scale that are under the direct control of the farmer and can be calculated as follows. In addition, the farm-gate NUE metric serves as an indicator of resource use efficiency that is related to both the economic (profitability) and the environmental sustainability of the farm system. The farm-gate nutrient balance approach, therefore, can generate indicators of both economic and environmental performance, which can help to benchmark the performance of a farm (against some target level of performance) and measure changes in performance over time linked to management changes.

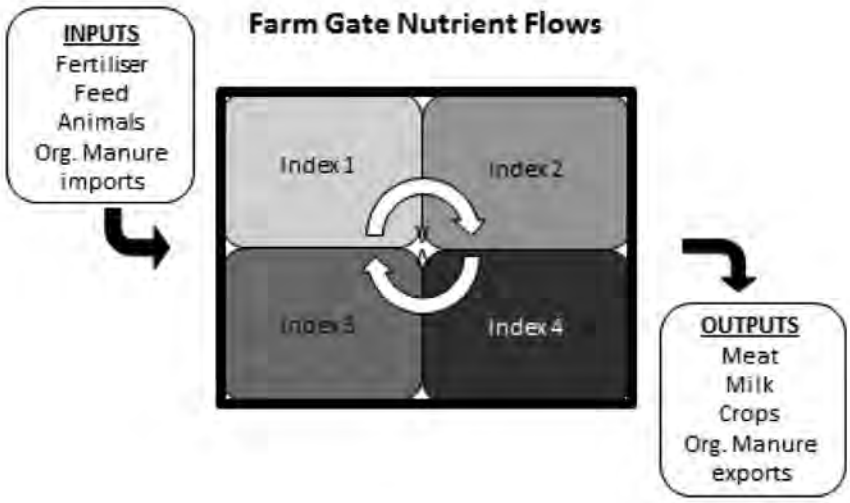

Figure 1. Farm gate nutrient flows, the nutrient balance is equal to nutrient inputs (N entering the farm in fertiliser, feed, manure etc.) minus nutrient outputs (N leaving the farm in milk, meat, crops, manure exports etc.).

Nitrogen balance (per hectare farmed), is used as an indicator of the potential magnitude of N surplus which reflects the risk of nutrient losses all other things being equal. It is calculated on the basis of N inputs less N outputs on a per hectare basis at the farm gate level. Whole farm nitrogen balance calculation, expressed as kg N per hectare is as follows;

$$\textit{Eq. 1} \qquad \textit{Nitrogen Balance (kg N / ha)} = \frac{\textit{Total N Imports (kg)} - \textit{Total N Exports (kg)}}{\textit{Grassland Area (ha)}}$$

On farms the nitrogen balance is typically a positive number and indicates how much surplus N, over and above what is being removed (exported), is being inputted per hectare. The higher nitrogen surplus the less efficient the farming system is in relation to N use.

Nitrogen use efficiency (NUE) is used to highlight the proportion of N retained within the farm system (N outputs / N inputs). This is a generic measure allowing comparison across disparate farm types at the farm gate level. Whole farm nitrogen use efficiency (NUE), expressed as the percentage of N inputted that was recovered in outputs (exports).

$$\textit{Eq. 2} \qquad \textit{Nitrogen Use Efficiency (\%)} = \frac{\textit{Total N Imports (kg)}}{\textit{Total N Exports (kg) X 100}}$$

On farms with grazing systems the NUE is typically low <30% and indicates that a small proportion of N inputs are actually recovered in the end products milk and meat that are sold. The remainder of the N that stays within the farm is usually either taken back up by the grass, stored in the soil, or lost from the soil to water or to the atmosphere. The N surplus (kg/ha N) and NUE% for sheep farms in Ireland are shown in Figure 2. The top preforming farms economically (Fig 2. Top) use more N fertiliser and have higher N surplus compared to the middle and bottom preforming sheep farms. However, these farms also have the highest NUE at on average 27% compared to the middle preforming farms (Fig 2. Middle). The bottom preforming farms (Fig 2. Bottom) can be categorized as more extensively managed with very low, N fertiliser use and hence had the lowest N surplus and high NUE.

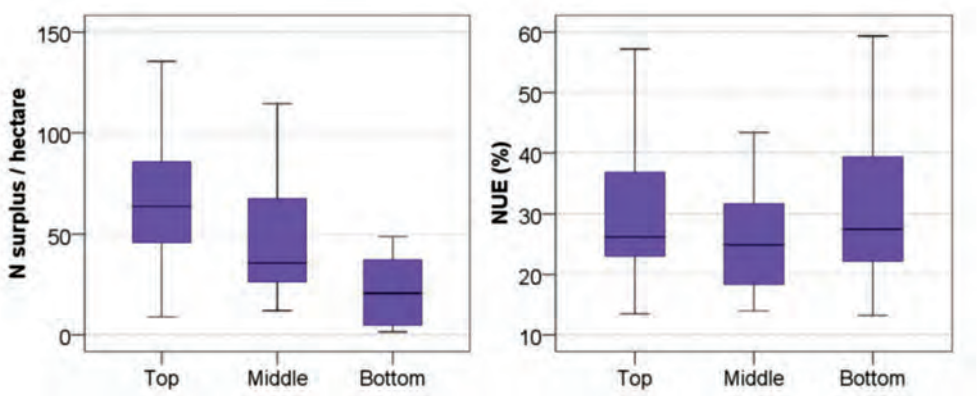

Figure 2. Nitrogen surplus per hectare (kg/ha) and nitrogen use efficiency (NUE %) on Irish sheep farms. Farms are segmented into the top, middle and bottom performing thirds based on gross margin per hectare (Teagasc National Farm Survey, 2019)

How can we improve N efficiency on sheep farms?

Future pasture-based sheep production systems will continue to be dependent on highly productive pastures combined with efficient ewes and lamb-progeny. Substantial additional gains in farm profitability can be achieved on most farms through refinement of the grazing system itself coupled with increasing N use efficiency. While the greatest gains in farm profitability will come from increasing pasture production and utilization followed by conversion to daily weight gain in sheep & lambs and this will also help to improve environmental efficiency. Lower N fertiliser use and concentrate feed imports, greater exports of agricultural products (livestock & meat) and relatively high stocking rates will drive increased NUE on sheep farms. A reduction in N fertiliser of 10 kg /ha will reduce farm GHG emissions by 1% and improve income by €10/ha.

Improvements in NUE and pasture productivity can be achieved by improving soil fertility, especially liming low pH soils, utilizing organic manure N sources efficiently including low emission slurry spreading application methods, using the right N fertiliser type (protected–urea) at the right-rate and the right time, improving grazing management and incorporating clover when reseeding poorly preforming swards. Improving farm management in these key areas makes good sense for overall farm production and profitability while simultaneously getting the environmental benefits for the farm.

Key areas for improving nutrient efficiency on farms

Lime: What effect does lime have in the soil?

Lime is a soil conditioner and reduces soil acidity by neutralising acids that build-up in the soil following fertilizer and manure N inputs, through weather of soils over time and following periods of high rainfall. Maintaining grassland soils within the optimum pH range of ≥6.3 creates a suitable environment for micro-organisms and earthworms to thrive and break down plant residues, animal manures and organic matter. This helps to release stored soil nutrients such as N, P, K, sulphur (S) and micro-nutrients for plant uptake. For example, grassland soils receiving regular lime applications have been shown to release up to 80 kg/ha additional N compared to soils with low soil pH. Important grassland plant species such as ryegrass and clover will persist for longer following reseeding where soil pH has been maintained close to the target levels through regular lime applications. When reseeding it is critically important take soil samples to assess soil pH (and nutrient) levels and apply lime where needed as ryegrass and clover seedlings will not tolerate soil acidity (i.e. soil pH less than 6.0)

Effect of lime on soil fertility and grass production

Recent research demonstrates the importance of lime in relation to nutrient availability and the improved efficiency from applied P fertilizer for example. Figure 3 shows the change in soil test P levels when lime

is applied by unlocking stored P in the soil (purple bar) and increasing the efficiency of freshly applied fertiliser P (green bar) compared to applying high quantities of P fertiliser alone (red bar). This clearly shows that soil pH correction is the first step to consider when setting out to building-up soil P levels for high grass production systems.

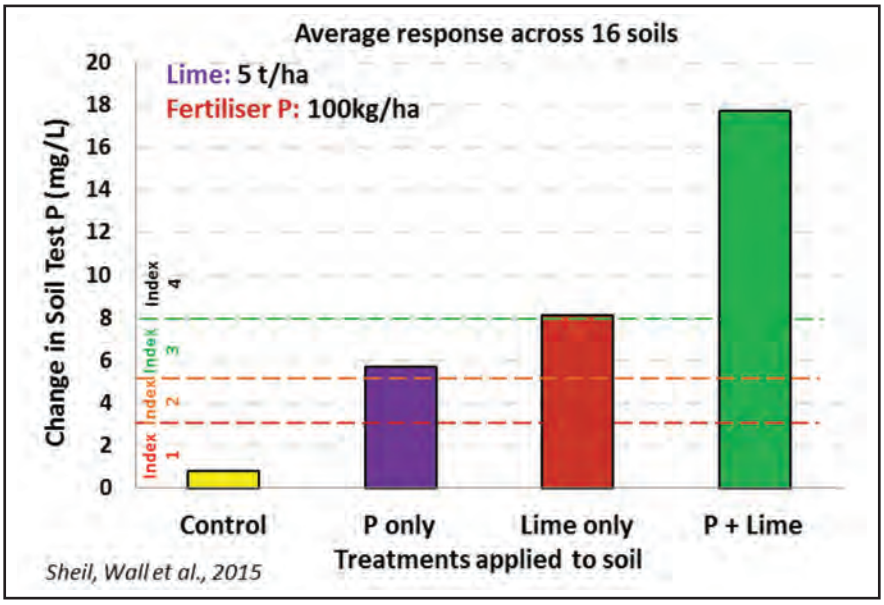

Figure 3. Average change in soil test P (Morgan's) across 16 soils (av. pH 5.5) treated with Lime (5 t/ha of lime), P fertiliser (100 kg/ha of P), and P + Lime and incubated over 12 months in controlled conditions.

Figure 4 shows the grass yield response to lime and P fertiliser in grassland. The application of 5t/ha ground limestone (purple bar) produced approximately 1 t DM/ha additional grass and had similar grass yields compared to the application of 40 kg/ha P fertiliser alone (red bar). However, the addition of lime + P fertiliser in combination (green bar) produced the largest grass yield response (1.5 t/ha more grass than the control). These results show how effective lime is for increasing the availability of both stored soil P (from previous fertiliser and manure applications) and freshly applied fertiliser P.

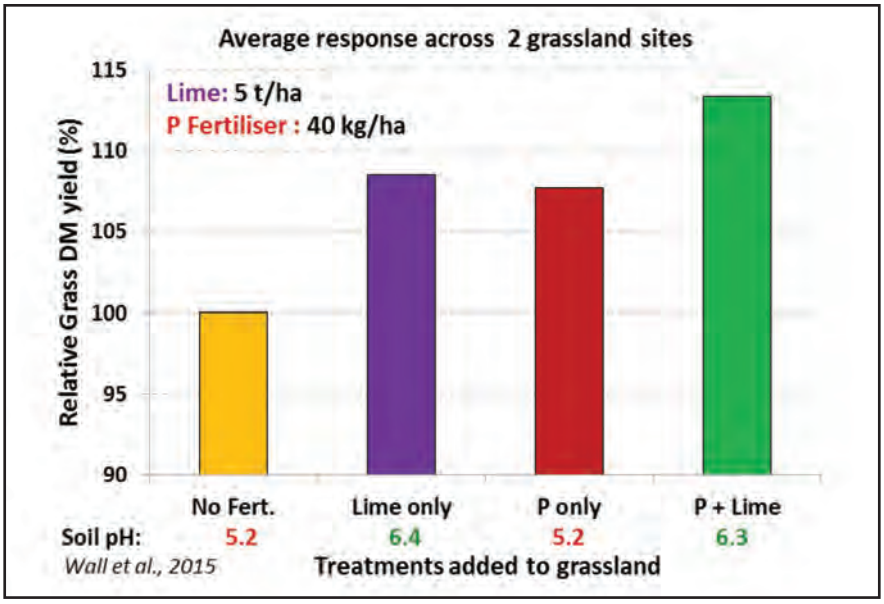

Figure 4. Relative grass DM yield response in grassland treated with Lime (5 t/ha of lime), P fertiliser (40 kg/ha of P), and P + Lime over a full growing season.

Return on investment in lime

As with any business achieving a positive return on investment is critical when using any input. When the pH of grassland soils are maintained close to the optimum range increased grass production by at least 1.5t DM/ha/year can be achieved. In addition to P and K release from the soil, N supply worth up to €80 euro may also be achieved to boost spring growth. If this extra grass production is utilized by the grazing livestock it has the potential to reduce farm feed bills by ~€160/ha year. Over a 5 year liming period this represents a 6:1 (grass €160/t : lime €25/t) return on investment in lime, not including the potential for reducing fertiliser costs into the future.

Protected urea: What is protected urea?

Protected urea has the same granule as normal urea that we have been spreading for years. The only difference is that a protection in the form of a urease inhibitor has been added to the granule. The most common inhibitor used is called NBPT and newer inhibitors also hold future potential. For 2020 the urease inhibitors 2NPT, and NBPT+NPPT are now also on the market and have shown to be effective. These inhibitors reduce ammonia-N gas emissions from the urea, which means that more of the fertiliser N is available for grass growth. Recent research at Teagasc Johnstown Castle critically found that protected urea had 71% lower GHG emissions than CAN and 79% lower ammonia-N emissions than urea.

How does protected-urea compare to normal urea and CAN?

Teagasc has conducted a large amount of work comparing protected urea to normal urea and CAN. Trials conducted by Teagasc measuring grass yield, GHG emissions and ammonia-N emissions where conducted at three locations (Cork, Wexford and Down) across the country for two growing seasons at different fertiliser N rates. The trails found that protected urea produced the same amount of grass as CAN (Figure 5) and has higher N use efficiency than normal urea due to reduced ammonia emissions.

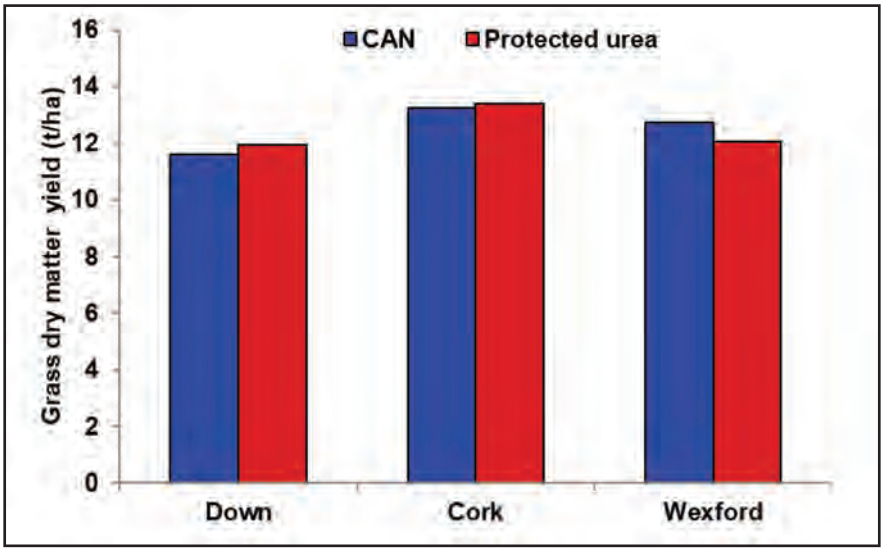

Figure 5. Grass yield from plots receiving either CAN or Protected urea at three locations across Ireland. *Source: Forrestal et al., 2017 & Harty et al., 2017.*

Where does Protected urea fertiliser fit in?

Protected urea is suitable for spreading throughout the whole grazing season. At present Protected urea comes as straight N (46%) or in a compound with potash and/or sulphur. It is currently not available in compounds with phosphorus. The fertilisers available with protected urea include:

- 46% N
- 40% N + 6%S
- 38% N + 7.5%S
- 35% N + 10%S
- 29-0-14+2%S
- 29-0-14+3.5%S

Straight Protected urea and compounds with Protected urea can be used on silage and grazing ground. Protected urea costs around €0.95 per N/kg and is very cost competitive compared to CAN which is costing around €1.05 per N/kg based on current fertiliser N prices.

Low emissions slurry spreading

Low emission slurry spreading (LESS) includes dribble bars, trailing shoes and slurry injection systems. The key difference between the techniques is how they place the slurry in the field during spreading (Figure 6).

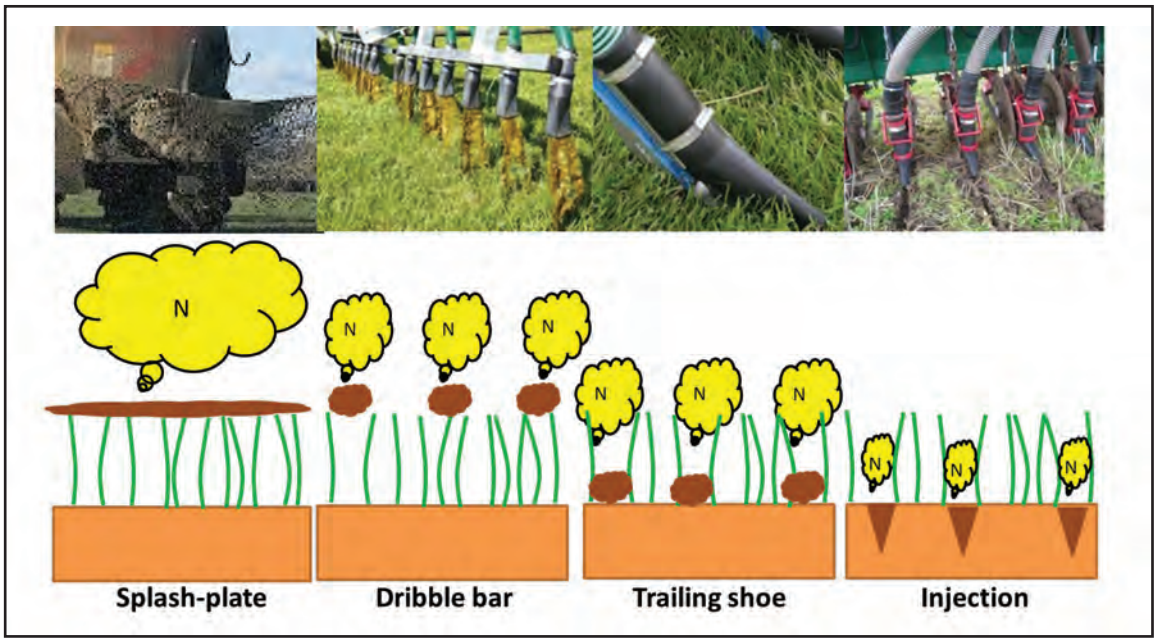

Figure 6. Slurry spreading techniques and there placement of slurry within the field during slurry application.

Slurry nitrogen efficiency

Low emission slurry spreading machines retain more of the N in slurry by placing the slurry in narrow lines (Figure 6). This reduces the exposure of the slurry to wind and sun (i.e. drying conditions) which reduces the amount on N in the slurry being lost as ammonia gas by 30%. Teagasc trials have investigated the N value of cattle slurry depending on the technique used and timing of application (Table 1). Using either the trailing shoe or dribble bar improves the efficiency of N within slurry by around 3 units of N per 1,000 gal compared to using splash-plate.

Table 1. Available N applications (kg/ha) from slurry applied in spring or summer using different slurry spreading methods

Slurry Application Rate	Spring N kg/ha *(units N/acre)*		
	Splash-plate	**Dribble bar & trailing shoe**	**Injection system**
11 m^3/ha (1,000 gal/ac)	8 (6)	11 (9)	14 (11)
22 m^3/ha (2,000 gal/ac)	16 (13)	22 (18)	27 (22)
33 m^3/ha (3,000 gal/ac)	24 (20)	33 (26)	41 (32)
	Summer N kg/ha *(units N/acre)*		
	Splash-plate	**Dribble bar & trailing shoe**	**Injection system**
11 m^3/ha (1,000 gal/ac)	4 (3)	7 (5)	10 (8)
22 m^3/ha (2,000 gal/ac)	8 (7)	14 (11)	19 (15)
33 m^3/ha (3,000 gal/ac)	12 (10)	20 (16)	29 (23)

Grass contamination/grazing efficiency

A large added benefit of LESS machines is their ability to significantly reduces grass contamination with slurry compared to the splash-plate. The ability to spread slurry into higher grass covers also increases the area of the farm that can be spread with slurry in early spring when ground conditions allow. This has advantages in terms of increasing the amount of slurry that can be spread which can help to free-up slurry storage during this period.

Soil Fertility

Optimising soil P and K fertility across the field on the farm is important on all farms which use moderate to high levels of N fertiliser. Where soil P and K fertiliser is low (Index 1 or 2) the efficiency with which grass can uptake and recover fertiliser N is drastically reduced. Figure 7 shows the relative NUE for grassland depending on soil P index. At P low P index (1 or 2) greater than 15% of the N applied is potentially wasted as it is not recovered by the grassland.

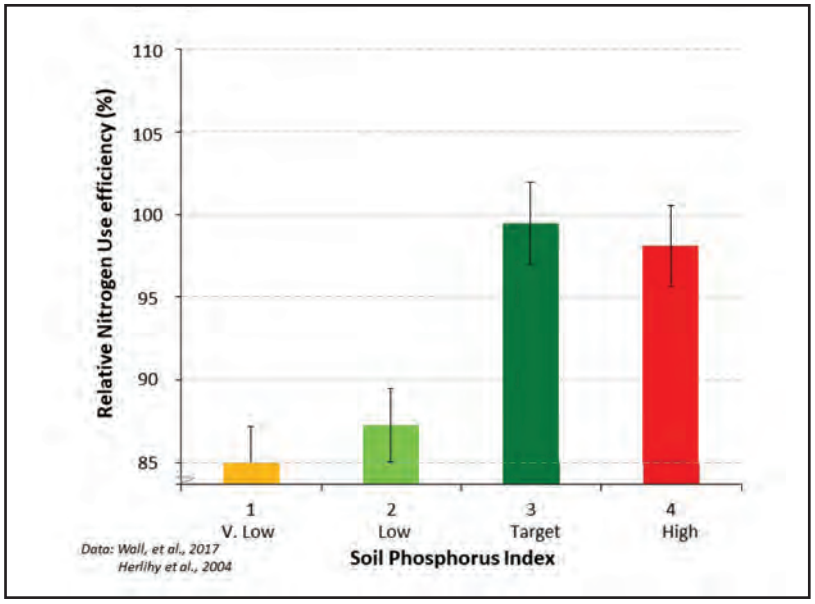

Figure 7. Relative nitrogen use efficiency by grassland depending on soil test P index (P index 1 to 4). Soil Fertility Planning

Good soil fertility is an essential ingredient on grassland soils and is a key driver of season long grass growth. Fertilisers now account for ~20% of production costs it is important to consult the farm fertiliser plan and prepare an annual fertilizer shopping-list. Soil tests are essential to measure available soil fertility (pH, P & K) on your farm. Changes to grassland farm phosphorus (P) limits under the new Nitrates Action Programme (NAP) have increased on farm chemical P fertiliser allowances where required. This will help ensure that the right fertiliser products are in place to meet grazing or grass silage crop requirements. Therefore, it is easier to tailor fertiliser plans, in terms of products, rates and timings, especially on low P fertility fields (Index 1 & 2). The fertiliser plan will also help decide where slurry / FYM should be applied and which fertiliser blends are most suitable. Information of fertiliser and organic manures types, rates and timings can be found in the Teagasc "Green Book" of nutrient advice (Wall & Plunkett, 2016).

Decisions around early season N fertiliser applications

In particular early season grass growth (January/February) is variable and response to early N are often very low leading to poor recovery of applied N. Therefore, careful consideration of soil and prevailing weather conditions is needed prior to applying N early in the growing season. Early N applications need to be decision based rather than calendar based. Nitrogen timings and rates will depend on stocking rate, soil type and grass demand during the season. Table 2 shows suggested chemical N fertiliser programmes on, with rates and timings for sheep farms at different stocking rates.

Table 2. Suggested dates and rates for chemical fertiliser N applications (kg/ha) for a well-managed sheep grazing system (mid-March lambing; no concentrates offered at pasture) with low to normal clover content[1]

Typical N application date	**10 ewes/ha** *(130 kg/ha Org. N)*	**12.5 ewes/ha** *(163 kg/ha Org. N)*	**15 ewes/ ha** *(195 kg/ha Org. N)*
	---------- kg/ha N ----------		
Late Jan/ mid -Feb[2]	33	33	33
Late March/ early April *(in 1-2 splits after 1st grazing)*	40	48	66
Late May/ early June	-	14	18
Late August	17	25	33
Total	90	120	150

[1] *For a high clover sward, only early application of about 35 kg/ha is necessary(depending on ewe productivity and stocking rate)*

[2] *The date of first application will depend on the lambing date. In mild areas, N may be applied from mid-January to mid-February. For all applications of chemical or organic N fertilisers, the periods during which application is prohibited under Nitrates rules (SI 605 of 2017) must be observed.*

Timing of P & K

There is a low to medium P and K demand on grazing areas of the farm as the majority of P and K is recycled back onto the pasture by grazing livestock. The ideal fertiliser blend for grazing ground tends to be a blend with a P:K of 1:2 for example fertilisers such as 18-6-12 or 10-10-20 type product as it supplies both P and K in the correct ratio. Aim to apply approximately 50% of the recommended P & K in spring once significant grass growth starts (i.e. 2nd or 3rd fertiliser round- March / April depending on soil type)

in the spring time. Apply the remaining P in 2 or 3 applications in May / June, during the period of peak grass growth, to ensure sufficient P in grazed grass for livestock. Apply maintenance rates of K during spring and early summer and apply K build-up rates in the late season (August/ September) where it is needed. This strategy will help to avoid problems with grass tetany, especially during animal turnout in early growing season.

Fertiliser Programme for sheep farms

Table 3 shows the typical fertiliser requirements (kg/ha) for grazed swards on sheep farms. Rates shown are total N, P & K recommendations before deductions for concentrate feeds or organic fertiliser applications. To account for P in concentrate feeds, use either actual P content in the feeds used if available, or alternatively, use a default value of 5 kg of P per tonne of concentrate feed.

Table 3. N, P & K recommendations for sheep grazing stocked at 130 to 170kg Org N/ha (10-13 ewes/ha)

kg/ha	Index	P kg/ha	K kg/ha	Fertiliser Programme (bags/ac)
135 (~110 units/ac) ( )= units/ac	1	30 (24)	75 (60)	3 x 18-2.4 bags 24-2.5-10
	2	20 (16)	45 (36)	2.5 bags 18-6-12 1.4 bags Protected urea
	3	10 (8)	15 (12)	1.3 bags 18-1.9 bags Protected urea
	4	0	0	2.4 bags Protected urea

** The above fertiliser programmes have not taken organic manure applications/concentrates fed into account. For all applications of chemical or organic N fertilisers, the periods during which application is prohibited under Nitrates rules (SI 605 of 2017) must be observed.*

Conclusions

Typically, sheep farming systems have the lowest overall use of N fertiliser inputs and this has important implications for achieving a sustainable balance between agricultural production and environmental source pressures at the farm scale, but also at the landscape, regional and national scales. Achieving further improvements in N efficiency on grazed grassland systems is a significant challenge for the future. Intensive grassland production systems must become more sustainable with lower nutrient surpluses and increased emissions efficiency. Irish sheep farming systems can grow sustainably based on combining highly productive swards and high genetic merit breeding ewes consuming a predominantly pasture diet. Considerable gains in both farm profitability and environmental efficiency can be achieved through improving NUE by incorporation of white clover into grassland swards coupled with optimum soil fertility, the use of protected urea fertilisers and low emissions slurry application methods where possible.

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Commercial data – how it benefits our breeding indexes

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Take home messages

- Genetics indexes should be used as a selection tool when selecting rams and pay careful attention to:
  - Across breed € value for the index of interest
  - Accuracy of the indexes
  - Star ratings of important traits for your production system
- A large proportion of commercial data is now feeding into the genetic indexes to allow for more accurate selection of rams that will perform in a commercial environment
- The inclusion of the commercial data has allowed for the development of across breed €uro-star indexes as well as a new health index

Introduction

Animal genetics is a powerful tool that allows farmers to identify superior (and inferior) animals to become the parents of the next generation; genetics has been shown to be directly responsible for over half the production gains achieved across livestock species. Genetics involves the passing of genes (favourable and unfavourable) from parents to offspring and unlike feeding or management it is permanent and cumulative. The introduction of national genetic indexes are crucial to enable farmers to make more informed breeding and selection decisions to ensure that they have the desirable combination of genetics for their flock. Previously a large proportion of the data generating the sheep genetic indexes was originating from pedigree flock. However, in recent years there has been a large emphasis placed on the collection of data from commercial flocks. These data allow for pedigree rams to be evaluated in a true commercial environment thereby, ensuring rams with positive attributes are identified for the commercial farmer. The objective of this paper is to review the current indexes and to highlight the important role that data from commercial flocks now plays in genetic improvement for the national sheep population.

€uro-star indexes

The Sheep Ireland €uro-star indexes were introduced in 2009 with the aim of providing sheep farmers with an additional tool for the selection of breeding animals. The genetic indexes aim to identify a low cost, easy care sheep with good maternal characteristics, but that also produces a good quality lamb that reaches slaughter at an early age. Each animal's index is calculated based on its individual animal performance (such as lambing information and weights) and data from the animal's relatives (i.e. sire and dam); currently this animal performance data feeds into Sheep Ireland from two main sources: commercial and pedigree data.

The establishment of a genetic index involves two main steps. Firstly, a list of traits or animal characteristics that influence the selection of an animal must be identified, secondly each trait is then weighted based on its economic value (€/lambs born) to farm profitability. A star rating is also assigned to each trait that

allows farmers to visualise the ranking of animals within their breed (1 star = bottom 20%; 5 stars = top 20% of the breed). The Sheep €uro-star indexes provide a measure of the genetic ability of the animal's progeny to generate profit at farm level for a combination of traits. The Sheep €uro-star breeding indexes are split into two indexes:

1. **Terminal index -** ranks animals based on their ability to produce live, fast growing terminal progeny with little lambing difficulty. This takes into account the progeny's growth rate, carcass characteristics, lambing and health data.

2. **Replacement index -** ranks animals on the expected maternal performance such as milk yield, lambing and health data, however, it also includes some terminal growth and carcass traits to account for the efficiency at which animal's progeny are finished.

The current emphasis placed on each of the trait groups within the Terminal and Replacement indexes are highlighted in Figure 1.

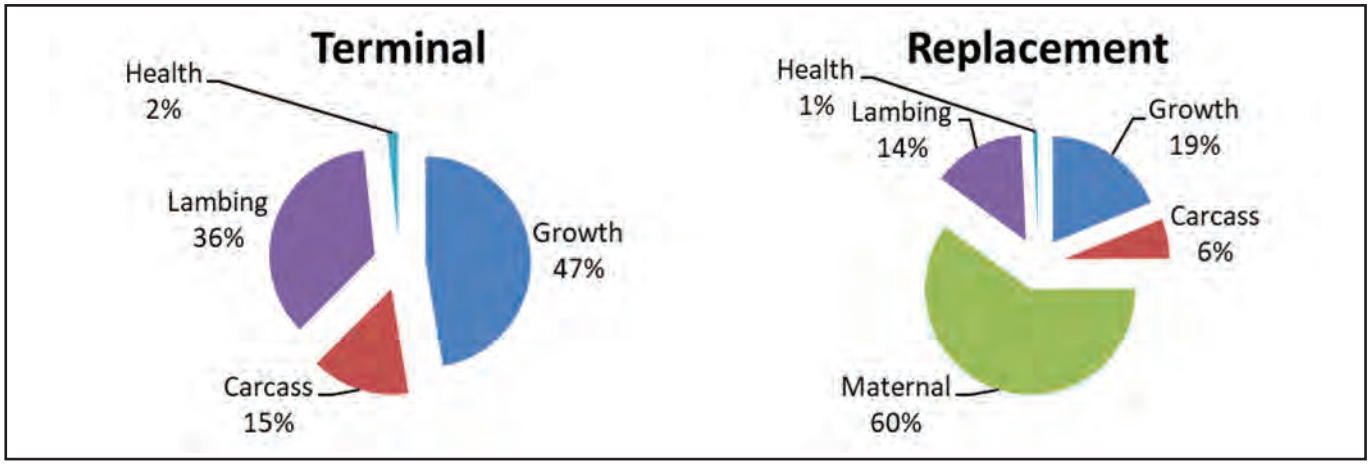

Figure 1. Relative emphasis of each trait group in the Terminal and Replacement indexes.

What to look for in the indexes?

Figure 2 shows an illustration of a sale catalogue that is available on all rams recorded as part of Sheep Ireland. Before selecting a breeding ram each farmer must determine the most suitable animal for their production system. For example, if farmers are interested in finishing all their lambs then they should focus on the Terminal index. On the other hand, if a farmer is looking to retain replacements as well as finishing ram lambs then they should focus on the Replacement index.

Irrespective of the type of animal that is needed, careful attention should be placed on the €uro-value, star rating and the accuracy associated with the index or trait of interest. The higher the accuracy (Acc) the greater the information that is known about the animal and the greater the confidence we have that their index value will reflect their true performance potential and thereby reduce the fluctuations in animal star ratings. The €uro-value is the predicted extra profit that will be generated for the animals progeny compared to an 'average' lamb, from 2019 onwards this value is now calculated across all breeds. Therefore this value can be used to compare the index value of a Charollais to a Suffolk ram. For example if a farmer is attending a multi-breed sale or is unsure of which breed to choose from then the €uro-star value should be the first value that you should focus on. Figure 2 shows the Terminal €uro-star value for the ram is €1.68, this means that this ram is expected on average to produce progeny that will generate €1.68 more profit compared to the average ram, irrespective of breed. Assuming that a ram is mated to

50 ewes per year and survives within a flock for 4 mating seasons this ram is expected to generate €500 more profit across his lifetime compared to the average ram. The star rating of each ram is still published within breed; therefore, this rating should only be used after a farmer has decided what breed they wish to purchase.

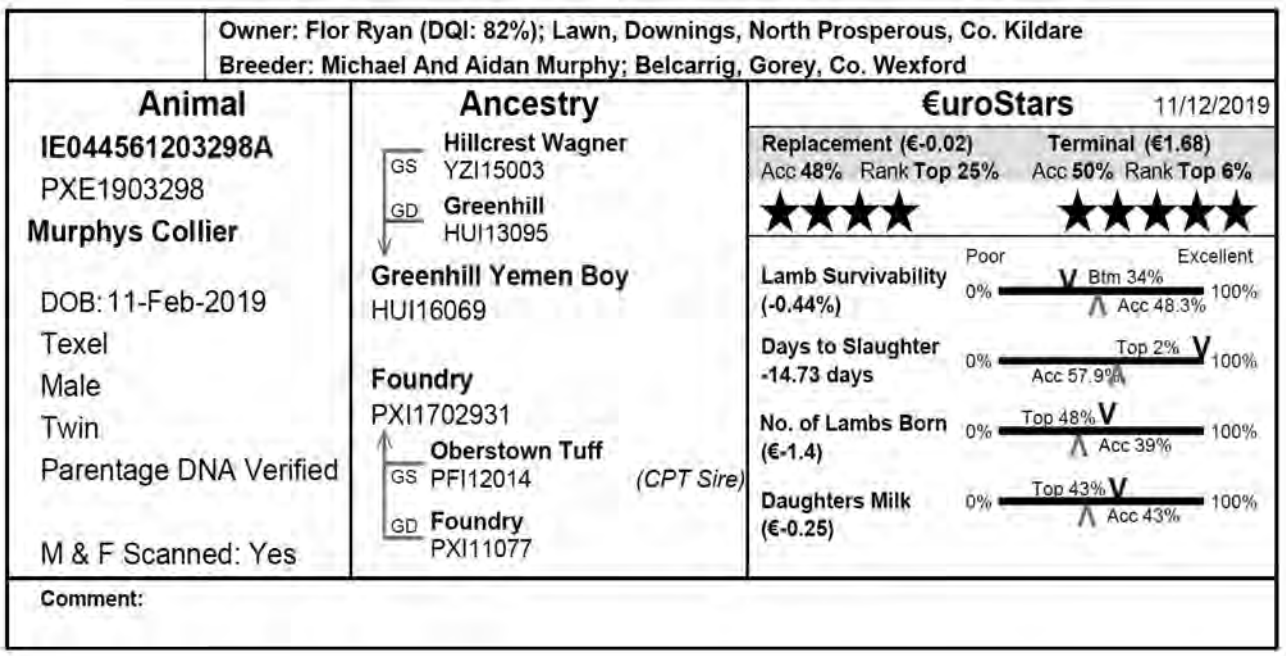

Figure 2. An example of an €uro-Star sales catalogue.

Data Quality Index (DQI)

The Data Quality Index (DQI) is an index that ranks each flock based on the quality and quantity of the data recorded on the flock over the previous year. This index can be used to help commercial farmers to identify pedigree flocks that are recording a large amount of data as accurately as possible. In addition the DQI allows LambPlus farmers to identify the areas where their data recording needs the most attention in the year ahead. The target DQI score is 80% or higher. The DQI reflects three aspects of the data recorded by breeders:

- Completeness — Has the breeder recorded all available information on the Sheep Ireland database
- Timeliness — Has this data been recorded and supplied to Sheep Ireland in a prompt manner
- Quality — Is the data accurately recorded

The DQI for each flock is now available on every sales card (see Figure 2) and is another step aimed at minimising the movement of evaluations of each ram.

Role of Commercial Data

Although €uro-star indexes are generally only available on pedigree rams, Sheep Ireland has placed increased emphasis in recent years on data generated on these pedigree rams on commercial flocks. Currently, a number of programmes are on-going to ensure that accurate data is recorded on a number of commercial flocks including the CPT (central progeny test flocks), the Teagasc BETTER farms, Teagasc research flocks and independent commercial flocks. In addition the Ovidata project, a European Innovation Partnership (EIP) project, aims to develop a model for commercial data capture.

In the commercial flocks rams from different breeds are mated to a central group of diverse commercial ewes and their progeny performance is recorded. Information on the progeny, managed in a commercial environment, feeds back into the genetic indexes of the pedigree rams used and also all his relatives. Currently, 10,000 ewe and 15,000 lamb records are produced annually with known ancestry (Figure 3) and detailed information such as lambing, lamb growth, health or ewe fertility performance. This data feeds directly into the evaluations of the rams that are evaluated on these commercial flocks but also on close relations of these rams. Data from commercial grass-based flocks now makes up approximately 50% of all data entering Sheep Ireland each year. This ensures that pedigree rams are tested in a pure commercial environment and should ensure that the genetic indexes of any pedigree rams are more reflective of how that ram would perform in a commercial flock. The inclusion of commercial data in the genetic evaluations also allows for additional information to be collected on animals that maybe difficulty to measure in pedigree flocks. This information includes carcass data and health data. Sheep Ireland are currently engaging with meat processors to ensure that data on commercial animals with known parentage information will be made available for inclusion in the genetic indexes. In recent years Sheep Ireland have ensured that all commercial ewes in their CPT and Ovidata flocks were scored by trained technicians for a number of health measurements, including mastitis, dag score and lameness. This allowed for the formation of the health sub-index to be included in both the Replacement and Terminal indexes.

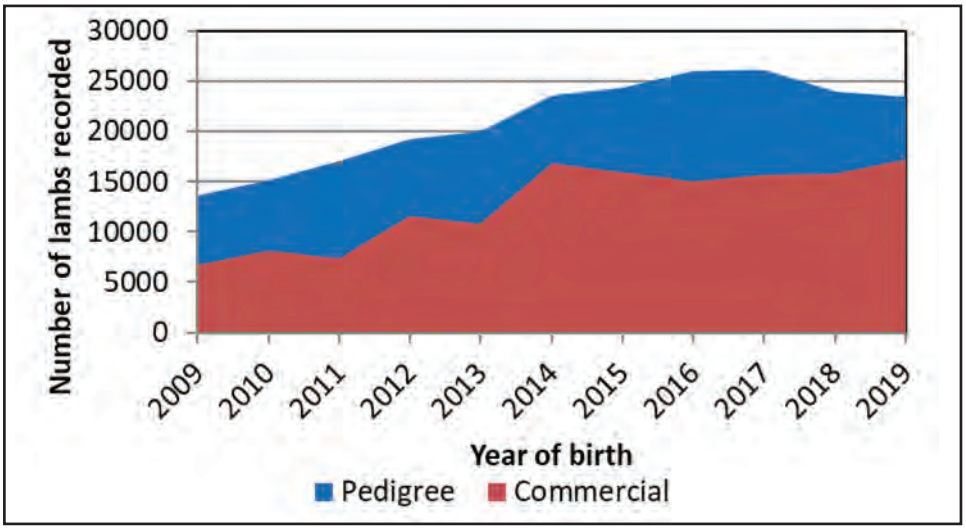

Figure 3. Number of lambs recorded on both pedigree and commercial flocks annually.

Sheep Ireland is now encouraging commercial farmers to start performance recording on their individual flocks. The use of new technology has now made it easier than ever to performance record in commercial flocks. These new tools include the availability of DNA parentage assignment through the use of genomics, the use of EID readers and the new Sheep Ireland recording App have removed the barriers to commercial data recording. DNA parentage assignment allows for the sire and dam to be accurately assigned to each lamb without the need for single sire mating or tagging of individual lambs at birth. This technology has been tested on the participating Ovidata flocks and has worked extremely well with parentage being predicted on each lamb. The parentage results also allowed genetic indexes to be derived on each lamb and, therefore, allowed each commercial farmer to make more informed selection decisions at weaning on the retention of replacement ewe lambs. Another interesting result from the Ovidata flocks was that where mob mating took place, 28% of the resultant litters that have two or more lambs were sired by more than one ram.

Monitoring commercial flock performance

Sheep Ireland now provides a service and the tools for commercial farmers to monitor flock performance. This information can be used by individual commercial farmers to assess the whole flock performance and doesn't necessarily need to include information on dam or sire of individual lambs. An example of the reports that are now available for flocks is shown below (Figure 4); this includes detailed management reports on pregnancy scan data, ewe and lamb weights and health data. These reports allow commercial farmers to identify their best performing ewes but more importantly the ewes that are underperforming in their flock and is another tool that can help farmers make more informed decisions at prior to mating.

Figure 4. Examples of management reports now available through Sheep Ireland.

The benefit of the commercial data within the breeding programme includes:

- More accurate evaluation on pedigree ram performance in a commercial environment
- Provides genetic linkage across breeds
- The generation of across breed genetic indexes
- The generation of the health sub-index within the Terminal and Replacement index
- Increased the rates of genetic gain within the breeding programme.

Conclusion

The €uro-star indexes are an important tool now available to sheep farmers to allow them to make a more informed decision prior to buying a ram for use on their flock. The large amounts of commercial data now feeding into the €uro-star indexes ensure that rams are ranked on their potential performance in a commercial environment. Teagasc and Sheep Ireland will continue to work closely with industry partners to ensure that continuous improvements are made to the €uro-star indexes.

Anthelmintic resistance in stomach and gut worms of sheep.

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Take home messages

- Four simple, cost-effective steps all lamb producers can take immediately to slow the development of anthelmintic resistance are:
- Treat mature ewes for stomach worms on the basis of demonstrated need only.
- Use 1-BZ products only to control Nematodirus.
- Implement a strong biosecurity protocol for incoming stock onto the farm which includes the use of one of the 2 new actives 4-AD or 5-SI.
- Use FEC to time anthelmintic treatments and to determine drench efficacy.

Introduction

Grazing sheep are naturally exposed to stomach/gut worms (gastrointestinal nematodes). A large number of different worm species can infect sheep but most follow a similar life cycle with both free-living and parasitic phases (Fig. 1). Eggs laid by adult female worms in the gastrointestinal tract are passed out with the dung. The eggs hatch to L1 larvae which feed on microbes in the dung. The L1 stages develop to L2 stages (which continue to feed in the dung) and subsequently to L3 (infective stage). The L3 migrate out of the dung onto the grass where they can survive for many months until ingested by grazing sheep. Once ingested, they travel to their preferred site of infection in the gut (abomasum or small intestine) where they further develop into mature adults which lay eggs. Worm larvae, therefore, accumulate on pasture over the grazing season and consequently, worms are generally a greater problem in the second half of the grazing season.

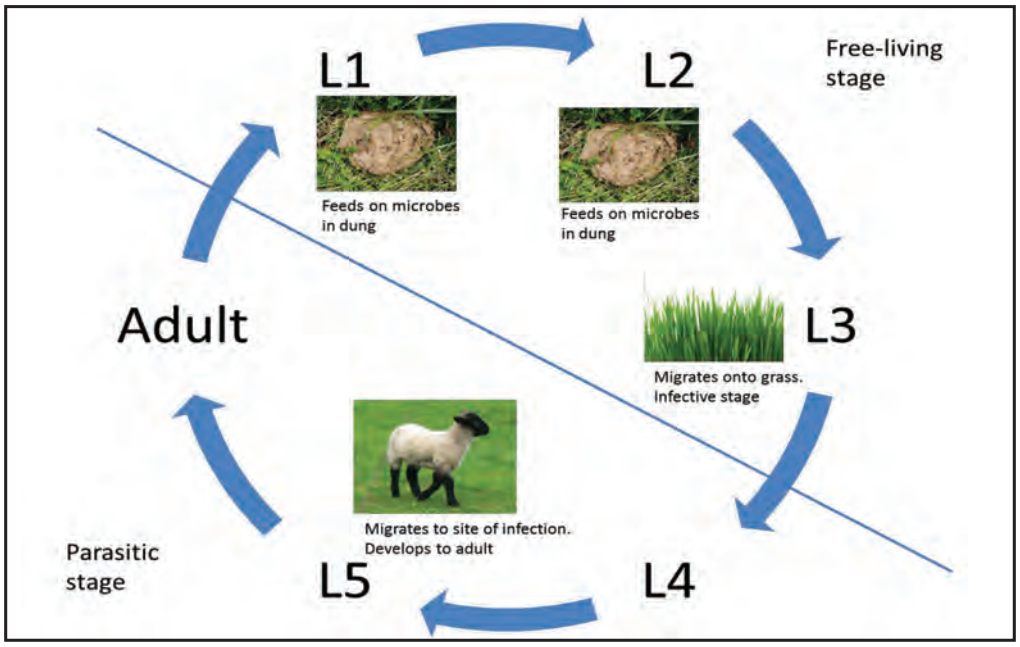

Fig 1. Stomach/gut worm lifecycle.

The most important gut worms infecting sheep are *Nematodirus*, *Teladorsagia* and *Trichostrongylus* species and the majority of gut worms that infect sheep will not infect cattle and *vice versa*. Gut worms can cause disease including scour and ill-thrift in naïve lambs but are commonly associated with appetite suppression and sub-clinical disease resulting in reduced growth rates. Sheep develop immunity to gut worms over time and generally have good immunity by 1 year of age.

Nematodirus

It should be noted that *Nematodirus* has a slightly different life cycle to the other gut worms. *Nematodirus* eggs require a prolonged period of cold weather followed by a period of warmer weather (>10 °C) to hatch. Therefore, eggs passed out by lambs in spring/summer can hatch in a synchronised manner the following spring and thus infect the following year's lamb crop. Lambs rapidly develop strong immunity to *Nematodirus* and usually have protective immunity by approximately 12 weeks of age.

Control of gut worms

Control of gut worms is generally achieved by the administration of broad-spectrum anthelmintics (wormers). Despite the large number of anthelmintic products on the market, there are currently only 5 classes of wormer licenced in Ireland for the control of gut worms in sheep. These classes are 1) benzimidazole (commonly known as white wormers (1-BZ)), 2) levamisole (commonly known as yellow wormers (2-LV)) 3) macrocyclic lactones (commonly known as clear wormers (3-ML)), 4) an amino-acetonitrile derivative (orange wormer 4-AD) and 5) spiroindole (purple wormer 5-SI). The latter two classes are veterinary prescription-only medicines. The product containing spiroindole is a combined formulation containing both a spiroindole and abamectin (which belongs to the 3-ML class of anthelmintics). See Table 1.

Table 1. Anthelmintic class, common name, chemical ingredient and worm stages affected

Anthelmintic class	Common name	Chemical ingredient	Stages affected
Benzimidazole (1-BZ)	White	Albendazole Fenbendazole Oxfendazole	Eggs, Larvae, Adults
Levamisole (2-LV)	Yellow	Levamisole	Adults
Macrocyclic lactone (3- ML)	Clear	Doramectin Eprinomectin Abamectin Ivermectin Moxidectin	Larvae, Adults
Amino-acetonitrile derivative (4-AD)	Orange	Monepantel	Larvae, Adults
Spiroindole (+ Abamectin) (5-SI)	Purple	Derquantel (+ abamectin)	Larvae, Adults

Anthelmintic resistance in Ireland

Anthelmintic resistance refers to the ability of worms to survive a dose that should kill them. Anthelmintics from different classes (1-BZ, 2-LV, 3-ML, 4-AD or 5-SI) have different modes of action. However, within the same class all products share the same mode of action and, therefore, when resistance develops to one product within a class generally other products in the same class are also affected. Anthelmintic resistance is a heritable trait which means resistant worms pass on genes conferring anthelmintic resistance to their offspring. When animals are treated with an anthelmintic at the correct dose rate, all susceptible worms are killed allowing only resistant worms to survive which results in resistant worms making up a

greater proportion of the worm population in subsequent generations. Therefore, the continuous use of anthelmintics can lead to the development of anthelmintic resistance. For that reason it is important that anthelmintics are used appropriately to help slow the development of anthelmintic resistance.

Faecal egg count reduction test (FECRT)

Anthelmintic resistance can be investigated on farm by a drench test or diagnosed on-farm using the gold-standard faecal egg count reduction test (FECRT). These tests involve collecting dung samples from 10 to 20 randomly selected lambs and determining the faecal egg count (FEC) using either a composite faecal sample consisting of an equal amount of dung from each animal (drench test) or determining FEC for each lamb (FECRT). Animals are then treated with the product to be tested. Dung samples are collected from the same animals after treatment (7 days post-treatment for levamisole; 14 days post-treatment for benzimidazole and macrocyclic lactone) and the egg count is again determined either from a composite faecal sample (drench test) or from faecal samples from each individual lamb (FECRT). The reduction in egg count after treatment is a measure of the effectiveness of the anthelmintic treatment. A fully effective anthelmintic dose reduces egg count to zero after administration. If the egg count reduction is less than 95%, then anthelmintic resistance is considered to be present (Coles et al., 1992).

Extent of anthelmintic resistance in Ireland

The extent of anthelmintic treatment failure on sheep farms in Ireland was investigated from 2013-2015 using drench tests. Composite faecal egg counts were conducted before and after anthelmintic treatment of lambs with benzimidazole (n = 550 farms), levamisole (n = 316 farms), avermectin (n = 405 farms) and moxidectin (n = 163 farms) (Keegan et al., 2017). To investigate the extent of anthelmintic resistance, faecal egg count reduction tests were performed on 19 farms in 2018-2019. The reduction in faecal egg count after anthelmintic treatment from both drench tests and FECRT were determined and results are shown in Fig 2.

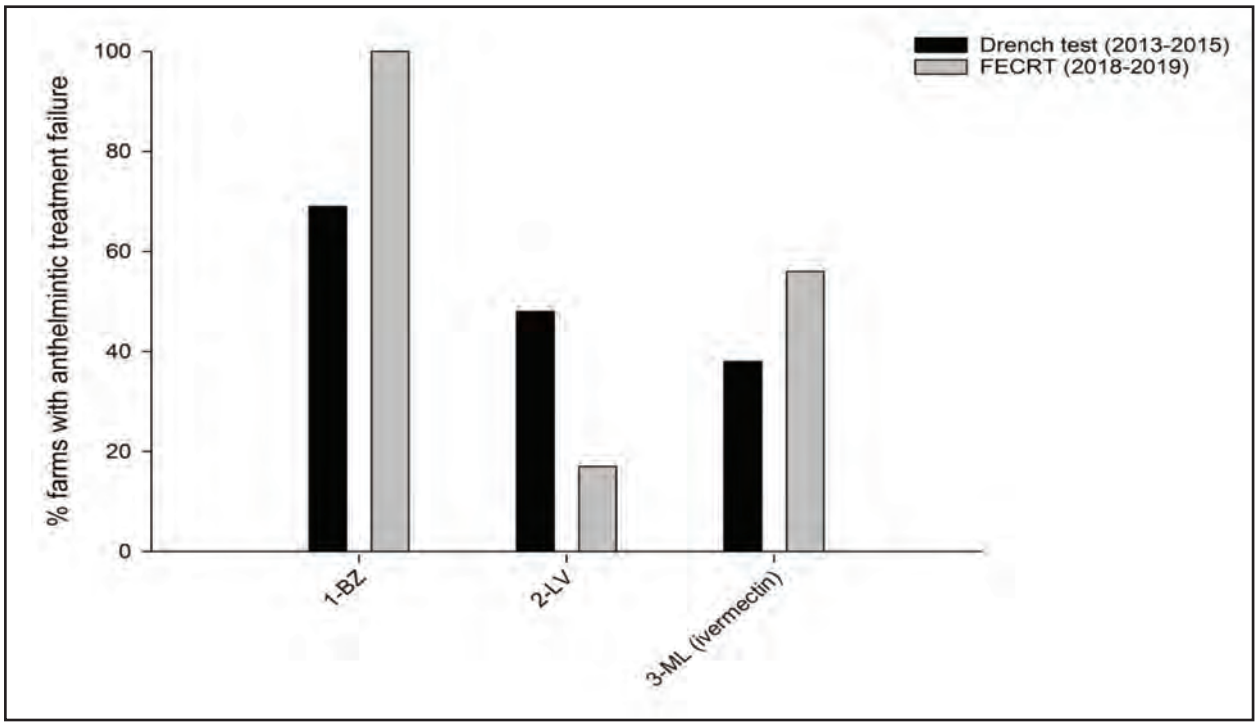

Fig 2. The percentage of sheep farms where anthelmintic treatment failure was detected i.e. treatment did not reduce the faecal egg count by at least 95% using drench tests (2013-2015, grey bars) and faecal egg count reduction tests (2018-2019; black bars).

Strategies to manage gut worms

Given the evidence for widespread anthelmintic resistance on sheep farms in Ireland it is important that sustainable strategies to manage gut worms and to delay the further development of anthelmintic resistance are implemented. This will involve a combination of grazing management and rational use of anthelmintics.

Grazing management

- Where possible keep the cleanest grazing, such as forage crops, reseeded ground or hay/silage after grass, for the youngest, most naïve animals on the farm.
- Lambs can be grazed ahead of older animals in a 'leader-follower' system.
- Mixed or sequential grazing of cattle and sheep will reduce the worm challenge for each as the majority of worms that infect cattle will not infect sheep and vice versa.
- Make sure that anthelmintic treatments do not coincide with the movement of animals to lowly infected pastures i.e. do not 'dose and move.'
- The impact of gut worms is lessened when animals are well-fed so ensure that all animals receive adequate nutrition.

Use of anthelmintics

1. Older stock has generally developed good immunity to gut worms and so mature ewes should not require dosing for gut worms. Lactating yearling ewes or thin or immunocompromised ewes may require treatment but this should be targeted to individual animals on the basis of demonstrated need.
2. There is widespread resistance to 1-BZ (white drenches) among mid-season worms. However, resistance to 1-BZ products among *Nematodirus* has not been detected. Therefore, only use products from group 1-BZ to treat *Nematodirus* in lambs.
3. A good biosecurity protocol for all bought-in animals should be implemented to prevent bring resistant worms onto the farm. Animals should be treated with one of the new anthelmintics (4-AD or 5-SI) and housed for 24-48 hours. They should then be turned out to contaminated pasture recently grazed by sheep.
4. It is important to use an effective product and determining which anthelmintic classes are working on the farm is the first step in ensuring the right product is used. Discuss how to test which anthelmintic classes are working on your farm with your veterinarian or adviser.
5. Use anthelmintics when necessary based on indicators such as flock-level faecal egg count. As such, monitoring for gut worms is important and should be an integral part of a flock health strategy. Worm burden can be monitored using faecal egg counts. In lambs a group faecal egg count of greater than approximately 500-600 eggs per gram may have an impact on performance and may indicate a need to treat for gut worms.
6. It is important that the correct dosing technique is used and animals are treated according to the manufacturer's instructions and dose rates. Check that the dosing equipment is delivering the correct amount before you treat. Weigh the animals to be treated or select or weigh a few of the biggest animals in the group to determine the dose rate and dose to the weight of the heaviest animal. If there is a large variation in weight in the group then consider splitting the group based on weight and then determine the weight of the biggest animals in each group and dose accordingly.
7. Avoid the continual use of wormers from the same class and avoid the use of combination wormer/flukicide products.

8. Consider the use of one of the new classes of anthelmintics (orange or purple class) once in later summer to remove any resistant worms that may have built up from previous treatments.

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Growing my farm; the challenges and progress to-date.

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Take Home Messages

- Increasing grass utilisation by managing and measuring grass has made a huge difference to my farm
- Adopting a consistent breeding policy, particularly to produce prolific replacements, is important to maximise flock performance
- Using the data from your farm, no matter how basic it is, is vital to make the correct decisions to improve performance
- Pre-lambing nutrition and maintaining strict hygiene at lambing and colostrum management are essential to minimise disease in newborn lambs and to ensure that lambs get a good start in life.

Introduction

I farm 34 Ha in two separate blocks either side of Ballinamore with my wife Amanda and our three children Peter, Lizzie and Dearbhla. My farm is located just outside Ballinamore, Co. Leitrim, where I operate a mid-season lambing flock alongside a dairy heifer contract rearing enterprise. Since 2010, I have also been a part-time retained member of the local fire brigade in Ballinamore and am involved in various local clubs and societies.

Currently, I am lamb approximately 200-220 ewes from the 10th of March onwards including ewe lambs which leaves me with a stocking rate of 12 ewes/Ha. There are also 80 dairy heifers being contract reared on the farm with 40 weaned calves arriving in June each year and going back to their parent farm at the point of first calving. During the winter months I also take in suckler cows for B&B depending on silage supplies and shed space available.

My farming history

I took over the farm from my father in the 1990's when it was a dairy farm milking 36 cows. However, as a result of the fragmented nature of the farm, heavy land, quota restrictions and a need for significant financial investment in facilities I decided to exit dairying in 2000. I changed the farm to a suckler cow system, selling the calves as weanlings through the local mart, as well as an 80 ewe sheep enterprise. Following a very wet year in 2012 and a review of my profit monitors I took the decision to get out of suckling during the winter of 2012/13 and increase the sheep numbers on the farm. While not an easy decision, the type of land I have meant my cows were spending up to 6 months indoors and more in wet years making it very hard to make a profit from the system. During my final year with suckler cows some of the cows were housed in June and didn't go back out to grass again that year due to poor ground conditions. A lighter type animal was needed! With my system now the sheep suit my land type and the type of dairy heifers I am rearing are 390-400 kg dairy crossbreds which are significantly lighter than suckler cows.

Joining the BETTER Farm Sheep Programme

In August 2013, I joined the Teagasc BETTER Farm Sheep Programme when I had approximately 120 mainly Suffolk cross and Texel type ewes. The previous year, 2012, I had purchased Belclare cross ewe lambs and hoggets to increase numbers and output from the flock which at the time I had a scanning rate between 1.6-1.8 lambs per ewe joined. At this time I was also selling all lambs by July/August with high levels of concentrates being used to finish the lambs with ewes also being fed concentrates post-lambing making it an expensive system.

Once I joined the BETTER Farm sheep programme a detailed farm plan was drawn up for the farm with the target being a gross margin from my sheep enterprise over €800/Ha, while maintaining a profitable cattle system on the farm. In order to achieve this target the plan was focused around four main areas; breeding policy, flock health, soil fertility and grassland management.

Breeding Policy

Given that I joined the programme in the autumn time the first thing that was looked at was the breeding policy. In order to increase the output from the flock I changed my breeding policy. I introduced a Belclare ram and began crossing it back to Suffolk type ewes and crossing a Suffolk ram back on my white faced ewes. I am still using a Texel ram on ewes I don't want to keep ewe lambs from and surplus ewes that I don't have Suffolk/Belclare rams for. Ewe lambs are bred to an easy lambing terminal sire, usually a Charollais.

Picture 1. Suffolk ram heading off with some of my Belclare type ewes at mating time.

Another area I focused on with my breeding policy was having ewes correct for breeding so I began to improve ewe body condition score (BCS) and record problem ewes during the year. In the past I would have flushed my ewes in the final four to five weeks before breeding without giving them too much attention prior to that. This often left me with a lot of thin ewes, particularly in wet years where grass would have been poor and scarce. In recent years after weaning the ewes are put into a bare paddock for a couple of weeks to dry off and then I pull off and mark the thin ewes and put with the ewe lambs. These are not forced to graze out paddocks as hard as the other better conditioned ewes. Marking the thin ewes means any ewes that fail to respond and improve condition are culled from the flock. My ewe BCS has increased over the years from focusing more on BCS and number of thin ewes in the flock at mating has also deceased. In 2013 at mating 15% of my ewes were less than BCS 3.0 while in 2019 this was only 6% with the target being to have ewes at BCS 3.5 and no ewes less than BCS 3.0.

During the first couple of years while I was building ewe numbers and trying to change breed type culling was not always as hard as it should have been. Now any ewe that has an issue during the year such as prolapse, mastitis, consistently lame etc. are marked using the electronic handheld device and culled after weaning. All my lambs are tagged 24 hours after birth and this allows me to mark ewe lambs that are from good mothers that didn't have any problems. This means that when it comes to picking ewe lambs I have another guide as to what lambs I want to keep. Depending on the litter size the lamb is from they get a different colour disc so I try to keep ewe lambs from ewes that had twins.

Scanning results for the mature ewes since 2014 are presented in Table 1 and as can be seen from the table for 2019, I had over 100 lambs more at weaning from the mature ewes alone compared to 2014 on

the same land base. Although lambing ewes lambs is extra work and they need to be run as an extra group until weaning, I have always lambed ewe lambs and found it good as it increases output. No replacement ewe lambs are kept from the ewe lamb group and supplementation is offered to the ewe lambs rearing lambs for the first four weeks after lambing and to their lambs until weaning. If there are any mature ewes and lambs really struggling they get put into this group as well.

Table 1. Ewe performance for 2014, 2017 and 2019.

Year	2014	2017	2019
No of ewes joined	162	201	180
Pregnancy rate (%)	91	93	98
Litter size	1.82	1.93	2.1
Lambs reared per ewe joined	1.48	1.60	1.94
Lambs Reared	240	322	349

Flock Health

Flock health is something I take very seriously on the farm, particularly after some bad experiences with different health issues over the years, some of which we bought in from outside the flock. As a result of buying in ewes from multiple different sources without full knowledge of their flock health profile I bought in both enzootic abortion and contagious ovine digital dermatitis (CODD) which I had previously had at low levels within the flock. Neither of these diseases had previously been on the farm and they were very expensive to get under control while also requiring extra labour. I now run a closed flock with the only sheep purchased being rams which go through a strict bio-security protocol when they arrive on farm. New stock go straight to the slatted house on arrival for at least 48 hours after being dosed with either a Group 4 or Group 5 wormer products to kill any potentially resistant worms they may be carrying. Bought in stock also receives a closantel based flukicide to kill any fluke in the animals. I also put new sheep through the foot bath and keep them separate after turnout for as long as is possible to ensure any lameness issues are not passed onto the other sheep in the flock.

During the summer months I collect lamb dung samples FECPAK analysis and I am dosing on to the results. In 2018, in conjunction with Teagasc, I did a drench resistance test on the farm and found that there is resistance to white drenches on the farm and very low levels of resistance to yellow and clear drenches. This was a stark finding and means that I am going to have to be very careful with how I manage the types of dosing products I use in the future. Although either a Group 4 or Group 5 wormer products are working, to ensure they stay working on the farm I only use them as part of the bio-security protocol and for my ewe lambs in the autumn. The continued use of the FECPAK before dosing is extra work but is vital to make sure I can control and manage the drug resistance levels in the flock.

I had low levels of abortion issues in the flock prior to 2014 when there was an abortion storm. Following on from this storm all of the ewes on the farm were vaccinated the following year and replacement ewe lambs are now vaccinated every year. The same protocol was applied for toxoplasmosis on the farm with ewe lambs vaccinated yearly. While it took a couple of years to get on top of the abortion issues we are hopeful we now have it under control now. For clostridial diseases ewes are on the Heptavac-P programme getting vaccinated before lambing, up until now I have not seen a need to do all the lambs.

I have had difficulty over the years with lamb mortality after lambing as well as through ewe abortions. In 2017 I lost 11% of my lambs between lambing and weaning which was reduced to 6% in 2019. While not exceptionally high in 2017 for my scanning rate the issue was that a high proportion of those dead lambs were lambs found dead in the field weeks after turn-out. While there are a number of potential factors causing this mortality since then I have overhauled how colostrum is managed on the farm and hygiene in the lambing shed which, I believe, has made a huge difference. Previously, where a ewe had multiples

or was short on colostrum I used only substitute colostrum to feed the lambs without mixing with ewe colostrum, meaning the lambs were not getting any antibodies from the ewe. Now where a ewe is short on colostrum, or she has three or more lambs, I milk what colostrum I can from the ewe first. I then divide this evenly across all her lambs using the substitute colostrum to top up the amount of colostrum the lamb is getting to 50ml/kg lamb birth weight. I then divide this evenly across all her lambs using the substitute colostrum to top up the amount of colostrum the lamb is getting. I aim to ensure all lambs have sufficient colostrum in the first hour targeting 50ml/kg lamb birth weight.

Over the last couple of years I have focused on improving the quality of silage I make. I have also looked more closely at the pre-lambing ration in more detail and am ensuring it contains a good quality protein in the form of soya bean meal. This has contributed to improved quantity and the quality of the colostrum in ewes at lambing time. This combined with a stricter culling policy mentioned earlier has greatly reduced the amount of ewes with insufficient colostrum at lambing time.

Picture 2. Inside of batch footbath converted from an old milking parlour on the farm

Lameness had been an ongoing issue on the farm that I was addressing fully. As ewe numbers increased over the years, I have converted a number of the previous cattle facilities to be used for the sheep including my old milking parlour. As shown in the picture below we back filled the pit in the old milking parlour and converted it into a batch footbath which all sheep go through any time they pass through the yard. I use zinc sulphate solution and as the footbath is roofed, I have only needed to change the solution three times a year. The footbath holds approximately 35-40 ewes and 60-80 lambs age dependent and has a guillotine gate that lets lambs out to a concrete yard to stand afterwards. Having good handling facilities is essential as when a job is easier to do it will get done quicker and easier. Converting cattle sheds and facilities over the years have provided good sheep facilities without breaking the bank putting them there!

Soil Fertility

One of the biggest changes I have made on the farm has been to improve my grassland management which has reduced the amount of concentrates being purchased, improved ewe and lamb performance off grass, improved silage quality and ultimately increased profit margins. In order to build stock numbers and increase the use of grass on the farm soil fertility had to be firstly addressed. In 2014 the entire farm was soil sampled and from the results a fertilizer plan was drawn up to address soil nutrient deficits and also maximise grass growth. Firstly, I had to spread lime to address low soil pH on the farm and given that land in Leitrim can be sold both by acre and by the gallon this leaves very tight windows to get lime out without causing severe damage to soil.

Traditionally I used to spread my first application of fertilizer no earlier than March 17th and that was only on the silage ground which would not have been grazed since the previous autumn leaving me with insufficient grass during the spring. The remainder of the land got its first application of fertilizer in mid-April after its first grazing. In recent years I have completely changed this and now the first round of fertilizer is ½ a bag of Urea/acre in early February. A fertilizer spreader purchased for the quad means that I can get fertilizer out even when the tractor wouldn't get through the gate and this has reduced soil compaction as well as ensuring early application of fertiliser. The next two rounds of fertilizer, which

begins after the first grazing in early April, is usually 18-6-12 before going back to straight nitrogen in the autumn, I have switched over to using Protected urea as my N source in 2019. I target my slurry on the low P & K fields and where I cut silage to try and replace the P & K taken off in the silage. Ground conditions means that most of the slurry usually goes on after silage cutting.

Grassland Management

In 2019 I was awarded the Teagasc Grass10 Sheep Grassland Farmer of the Year award which was a very proud moment for me. This is something I wouldn't have been able to believe when I joined the BETTER Farm sheep programme in 2013 and when I was handed a plate meter for the first time. Since then grass measuring has become a regular job on the farm and one that gives me the information and confidence I need to make decisions when managing my grass during the year. It was something that I took time to adjust to and see the benefit off, but, something I see as hugely important now. I also have a reseeding and a drainage programme for the farm which I have been progressively doing over the years. For me drainage of the heavy wet land I have is every bit as important as reseeding and I have tried every type of drain depending on finances and the ground type I am draining.

Picture 3. I use both netting and plastic wires for the temporary fencing which is allowing me to keep good grass in front of lambs throughout the year.

However, all of this is only as good as the management of the grass grown, I need to be able to utilise the extra grass which is where paddocks come into play on the farm. In the last few years I have went from 12 paddocks across the farm to 23 paddocks now which are further sub-divided using temporary fencing when needed. I began to use temporary fencing in 2015 as I felt I wasn't utilising enough of the grass and this allowed me to better control grass and make it easier to cut areas for silage where grass was surplus. The data coming back through PastureBase Ireland from my grass measuring gives me the facts and figures to be confident in my grazing decisions and plan ahead.

Pre-weaning ewes and lambs get approximately three to four days in a paddock or sub-divide now before they are moved to fresh grass with lambs grazing ahead of the ewes post-weaning. This was one of the biggest changes I made as previously I was leaving sheep in the same paddock for 7-10 days meaning they were going longer without fresh grass and being forced to work harder. For 2019 I grew on average a yield of 12.7 Tonnes of DM/ha, 10.1 Tonnes DM/Ha grazed and 2.5 T DM/Ha cut for silage on average. Post-weaning the lambs graze paddocks from 8-10cm down to 5.5-6cm, the ewes then graze out the paddocks to 4.0cm. I also find that by grazing the ewes behind the lambs during the summer and getting the ewes to graze out paddocks they are all getting a new paddock every 3-4 days which means they are not on bare ground for long periods of time helping improve ewe BCS.
Ultimately these changes in my grassland management are reflected in how I finish my lambs now compared to a number of years ago. I am feeding no concentrates to the mature ewes and their lambs

post-lambing which is a big change from where I was previously. I try to finish as many lambs off grass as I can but normally in August/September my land gets very wet and grass utilisation and lamb performance drops which requires the introduction of concentrates. At this stage once ram lambs reach approximately 40kg they are housed and finished to 45-47kg live weight on concentrates indoors. Over the last couple of years I have found that these lambs finish very quickly indoors once they are heavy enough when housed. Most years the majority of the lambs are housed for less than a month and some will even finish in two weeks. The fact I am putting most of the weight on using grass helps to keep costs down thus maximising my return on the lambs. Surplus ewe lambs are finished in a similar manner with as many finished off grass as possible and tend to be housed later if at all.

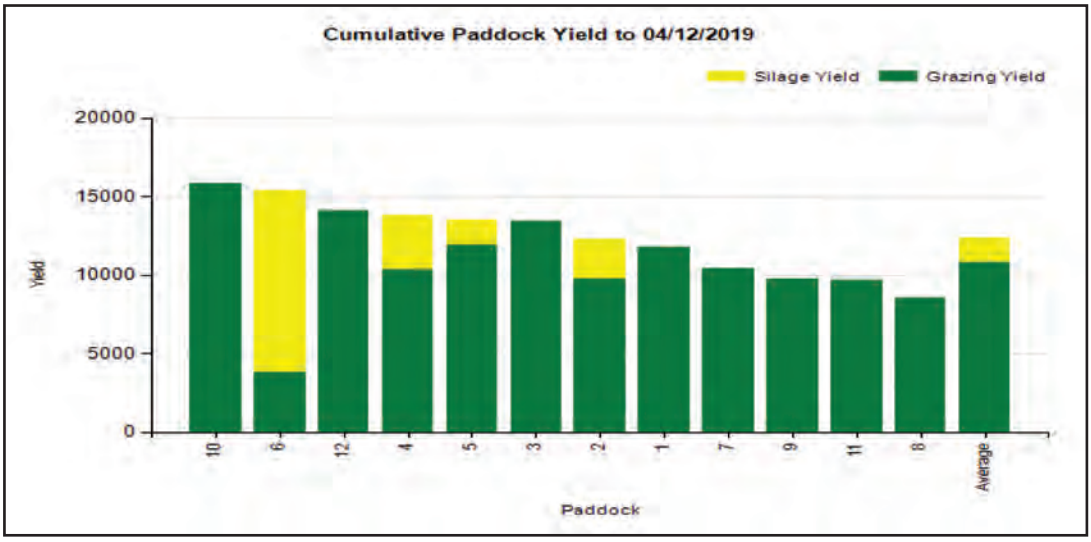

Figure 1. Cumulative grass yield on the home farm for 2019 from PastureBase Ireland account.

Financial Performance

Ultimately all this is only as good as the financial return on the farm. Since joining the BETTER farm programme I have managed to increase my gross margin per ha from the sheep from €351/Ha to €1244/Ha for 2019 as summarised in Table 2. This level of performance has taken a number of years to build due to initial investment needed when I began changing my system and costs around health issues over the years While last year was an exceptional year for me which is reflected in the financial performance of the flock I am hopeful I can keep my gross margin for the sheep enterprise around €1000/Ha going forward.

Table 2. Financial performance of the sheep flock in 2014 and 2019.

	2014	2019
Gross output (€/Ha)	923	2110
Variable Costs (€/Ha)	572	867
Gross Margin (€/Ha)	351	1244

Conclusion

All these changes I have made to grow my farm business have taken time but are now bearing results in terms of improved output and financial returns from the flock. Growing and utilising more grass, switching to a more prolific ewe and adopting a good flock health and biosecurity programme have been the most important changes made. I view this as still a work in progress, many tasks remain to be completed.

Meet the speakers

David Wall

David is a Senior Research Officer at Teagasc Johnstown Castle and leads the Nutrient Efficiency and Soil Quality research sub-programme. His research is focused on increasing the efficiency of fertilisers and manure use on Irish farms and development of soil specific nutrient advice. David is the responsible for the Teagasc Green Book of national nutrient advice for grassland and crops.

Noirin McHugh

Noirin is a Senior Research Officer at the Teagasc Animal & Bioscience Department, based in Moorepark , Co. Cork. She has been working as a sheep and beef geneticists with Teagasc since 2011. Her roles include improving the national genetic evaluations for sheep and beef and her research is industry focused with a direct route to application. Her current projects include investigating the role of genomic selection for the Irish sheep industry and validation of the €uro star Replacement indexes.

Dr. Orla Keane

Orla is a Senior Research Officer at the Teagasc Animal & Bioscience Department in Grange, Co. Meath. Orla has a first class honors degree in microbiology from Trinity College, Dublin. She also completed her PhD in molecular microbiology at Trinity College Dublin where she also graduated with a post-graduate Diploma in Statistics. She subsequently undertook post-doctoral studies in animal genomics and host resistance to gastrointestinal nematodes at the Molecular Biology Unit, AgResearch, New Zealand and in bioinformatics at the Department of Genetics in Trinity College Dublin. She has been a research officer at the Teagasc Animal & Bioscience Department since 2009 in the area of infection biology. Her particular interests are in intramammary infection and gastrointestinal nematode infection and the role of pathogen and host diversity in mediating the response to and outcome of infection. She has a particular interest in antimicrobial and anthelmintic resistance among animal pathogens.

John O'Connell

John farms in Ballinamore, Co. Leitrim, with my wife Amanda and their three children Peter, Lizzie and Dearbhla. He operates a 220 ewe mid-season lambing flock alongside a dairy heifer contract rearing enterprise. He is also a part-time retained member of the local fire brigade in Ballinamore and active in many local clubs and societies in his area. He joined the Teagasc BETTER Farm Sheep Programme in the autumn of 2013.

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