Animal & Grassland Research and Innovation Programme

Teagasc Hill Sheep Conference 2017

The Malton Hotel, Killarney, Co. Kerry

Wednesday 8th February 2017

Teagasc

Agriculture and Food Development Authority

Teagasc Hill Sheep Conference 2017

Programme

17:30	**KT sign-in**
18:00	*Chairperson: John Horgan,* *Regional Manager, Kerry/Limerick Advisory Region.*
18:05	**Conference Opening** *Professor Gerry Boyle,* *Director of Teagasc.*
18:15	**Why are you here Today? Focus on Take-Home Messages** *Michael Gottstein,* *Sheep Specialist, Teagasc, Macroom, Co. Cork.*
18:25	**Treatment and Prevention of Sheep Ectoparasites** *Tim Kirby,* *Bimeda Animal Health, Dublin.*
18:55	**Hill Sheep Sector in County Kerry: Current Profile and Potential** *Kevin O'Sullivan,* *Teagasc, Killarney, Co. Kerry.*
19:25	**Farming the Uplands -Where to From Here?** *Declan Byrne,* *Teagasc, Tinahely, Co. Wicklow.*
19:55	**A Scottish Perspective to Improving Hill Sheep Productivity** *Dr. Ann McLaren,* *SRUC, Hill & Mountain Research Centre, Crianlarich, United Kingdom.*
20:25	**Close of conference** *Professor Michael Diskin,* *Teagasc, Athenry, Co. Galway.*
20:30	**Refreshments**

Organising Committee:
Philip Creighton, Michael Diskin, Frank Hynes, Michael Gottstein, Ciaran Lynch, Fiona McGovern, Martin Mulkerrins, Noel Claffey and Frank Campion.

Foreword

The Irish Hill Sheep sector plays an important role in the economic health of rural areas and the maintenance of the natural landscape in many of Ireland's most scenic areas. However, low margins coupled with reduced support payments and often depressed markets for store hill lambs has seen the sector decline over the last two decades. Notwithstanding this, the Scottish Blackface hill ewe is very hardy and resilient breed and is hugely responsive to improved nutrition. The hill ewe has a significant untapped potential, both in the hill environment, and as the dam of prolific cross bred ewes for the lowlands. This Teagasc Hill Sheep Conference focusses on external parasite control, maximising the potential of the hill sheep industry in Kerry, managing upland habitats and on lessons we can learn from Scotland. Notwithstanding the physical and land quality issues that operate in the hill areas, it is clear from the results emerging from the Teagasc BETTER Farm Hill Sheep Programme that significant improvements in productivity and profitability are possible from relatively small changes in the main drivers of productivity. The results emerging from on-going studies with finishing of hill lambs in Teagasc Athenry also provides a clear roadmap for increasing the value of the hill lamb.

I welcome the increased focus of this year's Teagasc Sheep Conference on Take Home Messages. It's only when knowledge is applied at farm level that you see the benefits in terms of efficiency, productivity and ultimately profitability. Teagasc is strongly committed to its sheep research and advisory programmes. The expanded BETTER Sheep Farm Programme, the commencement of new studies on genomic selection in conjunction with Sheep Ireland, mineral nutrition, meat quality, and alternative forages are all relevant to hill and lowland sheep producers. Teagasc has recently recruited additional Hill Sheep BETTER farms. The increased collaboration between Teagasc, UCD, Department of Agriculture, Food and the Marine and Sheep Ireland, as well as overseas collaborators will be of further benefit to the sheep industry.

I would like to express my gratitude to all of the speakers who contributed both oral and written presentations and to you the attendance. This booklet collates and summarises a significant body of knowledge on technical issues in sheep production and should prove an invaluable reference to hill sheep producers. I would like to thank all the Teagasc Staff who assisted with the organisation of this Hill Sheep Conference and especially thank the organising committee without whose efforts we would not be here today – they are; Michael Diskin, Frank Hynes, Phil Creighton, Ciaran Lynch, Frank Campion, Fiona McGovern, Martin Mulkerrins, Noel Claffey and Michael Gottstein along with John Horgan and his staff in the Kerry/Limerick Advisory Region.

Director, Teagasc.

Contents

Treatment and Prevention of Sheep Ectoparasites

Tim Kirby

Bimeda Animal Health, Dublin.

Take home messages

- Preventative strategies are becoming increasingly important as part of an on farm control programme in tackling sheep ectoparasites. Increasing awareness of antimicrobial and anthelmintic resistance has emphasised the need for additional non chemical means of parasite control.
- Remember, use the right product in the right amounts at the right time and absolutely used and administered the right way.
- Good biosecurity – avoid introducing disease to your flock. Scab and lice are introduced by clinically or sub-clinically infested sheep. Quarantine policies are effective.
- Engage with your veterinary surgeon in creating a specific flock plan for your farm.
- Use diagnostic tools to assist in your treatment decision making process.

Introduction

External parasites (ectoparasites) reside on both the fleece and skin of sheep. In doing so, the parasite disrupts the normal skin defence barrier of the animal, thus potentially compromising animal health. Similarly, intense distress and discomfort can be caused by the presence of such infestations to the host, thereby impacting the animal's welfare. In Ireland, the main classes of ectoparasites that that effect hill sheep are scab mites, chewing lice, ticks and blowfly. Seasonality of the different parasites should be considered when devising an on farm control strategy, coupled with the correct administration of an efficacious product.

Prevention is better than cure

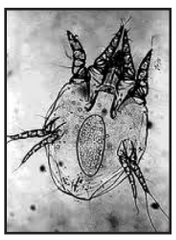
With increasing awareness and appreciation of responsible antimicrobial/anthelmintic use in all sectors of animal health, it is now incumbent on all stakeholders within the Irish sheep industry to embrace such practises. At a national level, adhering to such international industry expectations and standards is necessary in safeguarding consumer confidence in both Irish production systems and export lamb quality. In relation to hill flock enterprises, there are a number of preventative measures which can be implemented at farm level aimed at reducing the amounts and frequency of treatments used. These will be described throughout this discussion.

Permanent ectoparasites (scab & lice)

Sheep scab (Psoroptes ovis) & chewing lice (Bovicola ovis) spend their entire lifecycle on the host, therefore are referred to as permanent ectoparasites. It is widely accepted that the presence of such parasites within the national flock reduces profitability by millions each year. Losses are mainly incurred through lost production, mortality, ill thrift and medicinal/chemical treatment expenses. Currently, the control of permanent ectoparasites is generally on a reactive basis, taking place once flock infestation is clinically evident. There is the potential for such a non strategic control programme to result in overuse or misuse of chemical treatments.

Blowfly *(Lucilia spp)*

Scab *(Psoroptes ovis)*



Ticks *(Ixodes ricinus)*

Lice *(Bovicola ovis)*

Typically, diazinon based dip products used by non validated methods such as showers also have the potential to generate organophosphate resistance within the mite population. Additionally, the overuse of Macrocyclic Lactones (doramectin, ivermectin, moxidectin) injections also have the potential to generate resistance in multiple species such as intestinal worms and mites. Therefore, to maintain the efficacy of currently licensed treatments, it is necessary to adopt a well-defined flock preventative and treatment control programme on each individual farm.

Key point: Scab & lice can only be introduced to a flock by clinically or sub-clinically infested sheep. Therefore, the aim should be to eliminate such diseases from a farm/flock.

Preventative measures – scab & lice

The goal should be to eradicate scab & lice from the flock, therefore minimising direct introduction should be the first step in doing so. It is important to realise that sub-clinical carriers of scab & lice look clinically normal, however have great propensity to spread these highly contagious parasites to other sheep. Therefore, such practises as outlined below can be used to minimise the introduction.

Quarantine new stock

This is particularly relevant to rams and any stock returning from markets or being introduced from external flocks. In such cases, all stock should be quarantined on entering/re-entering the main flock and it should be assumed that all have scab. Suitable facilities are essential to accommodate lambs and heavier sheep, also in significant numbers. It is also advisable post treatment to have these newly introduced sheep turned out to a "dirty pasture" and segregated from the main flock for up to a three week period. This minimises pasture contamination and lessens the risk posed to other sheep.

Buy well

When purchasing sheep, it is highly advisable to assess the health status of the entire flock at source. If there is any suspicion or evidence of scratching in the flock, then it is not recommended to purchase or acquire sheep from such a source. Also, the general health status of the flock provides a backdrop to previous management and health programmes. Reviewing recent health records is also advisable.

Disinfestation

It should be realised that scab mites and lice can survive off the sheep for 17 days, and still infest other sheep. Therefore, mites which are deposited in the environment and in vehicles allow for the passive transfer to other in-contact sheep. By steam cleaning trailers or use of suitable detergents such as hypochlorite, the risk of introducing lice or scab to a flock is lessened.

Biosecurity

As described, it is possible for residual mites and lice to be indirectly carried on farm by vectors such as scanners, shearers and vets. Having good control measures in place such as foot baths and use of overalls will help offset such risk.

Good fencing & avoid shared grazing

These measures minimise the flock from coming in direct contact with infested sheep from neighbouring sources.

Diagnostics

As with any disease, it is prudent to confirm and identify the causal agent prior to any treatment. As with scab, your veterinary surgeon can confirm the presence of the parasite through skin scrapings. Additionally, a blood test which detects a specific mite antigenic protein is also commercially available. The use of diagnostic tests will ensure that the most appropriate treatment is used for the target parasite and offers the best investment of resources.

Table 1. Chemical treatment of sheep ectoparasites

Active ingredient	**Controls**			
Plunge Dips	**Scab**	**Blowfly**		**Tick/Ked/lice**
Diazinon (OP)	Yes	Yes		Yes
High-Cis Cypermethrin	Yes	Yes		Yes
Pour-ons (all non-OP)		(Prevention)	(Treatment)	
Cyromazine	No	Yes	No	No
Deltramethrin	No	No	Yes	Yes
Alpha-Cypermethrin	No	Yes	Yes	Yes
High-Cis-cypermethrin	No	Yes	Yes	Yes
Dicyclanil	No	Yes	No	No
Injectbables				
Ivermectin	Yes	No	No	No
Doramectin	Yes	No	No	No
Moxidectin	Yes	No	No	No

Key point – Rotate products used and prevention is better than cure.

Semi –permanent ectoparasites – ticks and blowfly

The most common semi – permanent ectoparasites (those which complete their life cycle off the sheep) relevant to Irish hill sheep producers are the tick species (Ixodes ricinus) and blowfly larvae (Lucilia sericata). The threat posed to hill lambs in particular by tick borne diseases is significant. Ticks are associated with rough and unimproved pastures. During the life cycle of the tick, each stage must feed on an animal for a short period of time to obtain a blood meal. Farmers notice the adult female ticks in particular attached to the sheep skin, engorging in those areas not covered by wool. Ticks are particularly numerous in the spring but can be seen at any time of the year. At this time, their feeding causes abscesses in the joints, spine and internal organs of lambs. This is known as "tick pyaemia" and badly affected lambs cannot keep up with their mothers and die of neglect.

Ticks also transmit a viral disease of the nervous system called "louping ill" and Anaplasma phagocytophilium, the causative agent of tick borne fever. Tick borne fever can also cause abortion in pregnant ewes and temporary infertility in rams where animals are previously unexposed. On farms where this agent is a problem, management of replacements is undertaken to ensure exposure prior to the risk period. On farms where louping ill disease is a problem, vaccination is advised.

Traditionally ticks were controlled by dipping ewes shortly before lambing and the lambs shortly after birth. It is however, very laborious and stressful to dip heavily pregnant ewes and pyrethroid pour ons are now widely used instead. Dipping may still be required on farms with a severe problem associated with high populations of deer which act as alternative hosts for this parasite. It is not desirable to totally eliminate ticks from a farm since a small residual population is required to maintain hill cattle's immunity to redwater fever. Pasture improvement and in particular regular controlled grass and heather burning will substantially reduce tick populations. Farmers and shepherds should be aware of the possibility of contracting Lyme disease from tick bites also.

Likewise, headfly can cause problems during summer months. Animals suffer from disrupted grazing patterns and affected sheep isolate themselves in shaded areas. They may stand with the head held lowered with frequent shaking and ear movements. Alternatively, the animal may adopt an extended neck position whilst in sternal recumbency. Kicking at the head often greatly exacerbates damage caused by headflies and such action may also traumatise the skin of the ears and neck. This is also recognised as a significant animal welfare issue. Body condition is quickly lost and the fleece quality is also adversely affected. Topical emollients and antibiotic preparations are not usually necessary and the skin wounds heal well provided that flies are denied access to these areas. Housing is essential for sheep with large skin lesions to allow time for complete healing. Application of a suitable pour on formulation prior to the anticipated headfly season is essential in horned sheep especially. Suitable preparations are described in Table 1.

Blowfly lesions (maggots) may range from centimetre diameter areas of the skin with a small number of maggots, to extensive areas of traumatised/devitalised skin causing death of sheep in neglected cases. Animals must be checked on a daily basis for the presence of fly strike during high risk periods. Adult flies are attracted to areas adjacent to faecal staining surrounding the perineum, and less commonly virulent footrot lesions with exposed granulation tissue and urine scalding around the prepuce. In severe infestations, the sheep are depressed and isolated from the flock. Affected sheep can be treated by plunge dipping using an organophosphate preparation; however, it is more usual to treat individual infested sheep with dip wash applied directly to the struck area after first clipping away overlying wool.

Before preventative measures using various chemical formulations are considered, much can be done to reduce the attraction of blowflies for example a grazing programme to prevent massive build-up of infective helminth larvae on permanent pasture during July and August. This aim is to reduce diarrohea caused by high parasite burdens. Where faecal staining of the perineum occurs, this wool should be removed by "dagging". In adult sheep, removal of the fleece and faecal contamination by shearing during late May/June removes this attraction well before the peak blowfly season.

Dimpylate (diazinon) and propetamphos are effective against blowfly strike for up to six weeks. These compounds are highly lipophilic and concentrate in the wool grease of the animal. Recent reports suggest that upto 25% of all Irish sheep are not correctly dipped, thus minimising the chances of product efficacy and propagating resistance. It is always essential to follow all instructions on a product data sheet. Topical application of high cis-cypermethrin pour-on preparations provides protection against fly strike for upto 6-8 weeks at the site of application. The insect growth regulator cyromazine, applied before the risk period is effective against blowfly strike for upto 10 weeks after topical application and dicyclanil offers 16 weeks full body protection.

Good treatment practice

It is prudent to consult with your veterinary surgeon to ensure that you are using the correct product for the target parasite, and not selecting for resistance. Recent surveys performed in the British isles suggest that:

- Doramectin and Cyromazine are often inappropriately used for the control of ticks and lice. The misuse and overuse of such products increases the risk of resistance developing.
- Many respondents described the use of wormers for the treatment/prevention of blowfly strike. However, wormers do not target the ectoparasite and since scouring is not only caused by worms, the use of wormers to control blowflies may contribute to the development of wormer resistance, and is, therefore, not considered to be an appropriate strategy for blowfly control.
- Wormers from the Macrocyclic lactone (MLs) group (Doramectin, Ivermectin, Moxidectin) are often used to treat scab. However, we must ensure that the MLs remain viable to control internal parasites also.

Summary guidelines for effective ectoparasite control

- A few relatively simple measures can help to prevent ectoparasite infestations on farms, thereby saving considerable time and costs.
- Think prevention before cure.
- Good biosecurity is critical. Quarantine and treat all incoming stock for at least three weeks. This saves added cost of labour in having to treat an entire flock should an infested sheep be introduced.
- Maintain field boundaries & gates so that neighbouring stock cannot stray or make direct contact with your flock.
- Work with neighbours. Particularly those sharing common grazing so that your combined control strategies can be most effective.
- If sheep do show signs of skin parasites, make sure that you get an accurate diagnosis before treatment. Your vet can identify the parasite and advise on the correct course of treatment which could save considerable money.
- Administer the correct treatment properly. Only use licensed Veterinary Medicines and follow the manufacturer's guidelines for use and disposal of the product exactly, thereby maximising product efficacy and minimising environmental contamination. Selection of unsuitable treatments is often ineffective and can select for drug resistance.
- Ensure that ectoparasite control is included in your flock health plan and consult with your vet on the most appropriate treatments for your sheep

Hill Sheep Sector in County Kerry: Current Profile and Potential

Kevin O'Sullivan,

Teagasc, Killarney, Co. Kerry

Take home messages

- Hill sheep have a vital role in maintaining the natural landscape.
- Improve ewe body weight and condition score at mating has a major impact on the number of lambs born and reared the following spring.
- Crossbreeding has the potential to significantly increase output and margins on hill farms
- The potential for breed improvement of hill sheep is not being realised and requires more effort from all the stakeholders.
- Participation in producers groups is strongly recommend

Introduction

The land type of South and West Kerry together with West Cork consists mostly of upland topography which is mostly suited to grazing by hill sheep. Most landowners who operate hill sheep enterprises have some owned upland but also a considerable amount of commonage is farmed. Commonage lands in Ireland are mainly situated along the western coast with Donegal, Mayo, Galway and Kerry containing almost 71% of the total commonage land declared nationally in the Basic Payment Scheme. In Kerry approximately 54,000 ha of commonage is declared in the Basic Payment Scheme (DAFM). The County Kerry Agricultural Resource Study, 1972, classifies 38 % of the land type of County Kerry as Mountain and Hill which consists of an area in excess of 180,00ha.

Sheep farming is a very significant land use in West Cork and Kerry with the 2015 Sheep Census recording 363,811 ewes in the region of a total number of 504,485 sheep recorded for the region. Of this figure 285,036 are hill ewes with 76.1% of all sheep in the area recorded as hill sheep. Thirty four percent (34%) of the national hill sheep flock is found in the region with 940 and 1,889 hill sheep flocks in Cork and Kerry, respectively (DAFM). Lowland and Hill sheep numbers for Cork and Kerry are summarised in Table 1.

Table 1. Lowland and hill sheep numbers for Cork and Kerry. (National Sheep Census 2015)

	Hill Ewes	Total Hill Sheep	Total Lowland Sheep	Total All Sheep	% Hill Sheep
Cork	78,664	119,014	70,364	189,378	62.8
Kerry	206,372	264,899	50,208	315,107	84.1
Total	285,036	383,913	120,572	504,485	76.1

The most popular breed of hill ewe in this region is the Scottish Blackface and to a lesser extent the Cheviot along with some hill crossbreds. A common practice on hill farms in the region is to use some lowland rams (Suffolk, Charollais, Texel etc.) on a proportion of the hill ewes to produce earlier finishing and more valuable store lambs. Work carried out on the Teagasc BETTER sheep programme has clearly demonstrated that crossbred lambs are on average 3kg heavier at weaning (Lynch & Diskin, 2014) compared with pure Scottish Blackface lambs. Consequently, there is a considerable advantage to be gained by mating hill ewes, which are not destined to produce hill flock replacements, with lowland sires.

Potential for improvement

There are a number of areas where potential improvement could be made either at an individual flock or at an industry level and these are briefly discussed.

Increasing weaning %

Typically output from hill flocks is low, in the order of 0.8 lambs weaned per ewe joined. However, through better management there is potential to improve this figure substantially. Research carried out by Teagasc at Leenane and more recently by Teagasc as part of the Sheep BETTER Farm Programme has demonstrated potential for improving output from hill flocks by improving ewe condition and weight at joining (Lynch & Diskin, 2014). This centres on a management plan for the flock and the farm to improve the liveweight and body condition score of the ewe prior to mating.. The results coming from the work on the BETTER Farm Hill flocks clearly shows that it is possible to increase ewe output at least in some Hill flocks from a current figure of 0.8 lambs per ewe mated to over 1.1 lambs per ewe. This improvement has also been shown to be economically advantageous (Lynch & Diskin, 2014). For hill flocks the aim should be to have ewes in a condition score of 3 at ram joining and with a target mature weight of 45 kg. for 'harder' hills and 50 kg for those with greener hills or access to lowland areas (Lynch & Diskin, 2014). The steps taken to improve output in hill flocks in the BETTER farm programme will be described in later sections.

More cross breeding

For many of hill flocks (weaning 0.8 lambs per ewe or greater) in county Kerry and Cork have the potential for more cross breeding, unless they have a specific market for 'pure' females there is. There are a number of ways to exploit this to the benefit of hill sheep farmers, some of these benefits are as follows:

- Prolific females for lowland farms such as Mule, Greyface and Belclare crosses, ewe lambs or hoggets.
- Heavier lambs (3-4 kg at weaning)
- More saleable cross bred wether and ram lambs.
- Better selling price
- Improved performance post weaning and during the finishing period

Ultimately the potential for crossbreeding for each hill flock will depend on the level of output they are capable of achieving. In most cases the replacement rate requirement for the most part is determined by the existing level of ewe output and level of culling/loss incurred. A guideline for the percentage of a flock that is required for producing replacements is outlined in Table 2. Crossbreeding a part of their hill flock is an option that Kerry and West Cork hill producers should give more active consideration to. Within Kerry and West Cork from the 250,000 plus hill breeding ewes, even at low levels of output (i.e. 0.8 – 0.9 lambs per ewe joined) there is potential to produce in excess of 50,000 crossbred lambs. This would give 25,000 ewe lambs suitable for replacements and for sale each year. There is clearly a valuable resource within the hill flocks of Kerry and West Cork that could be further exploited if there were more organised sales of crossbred females such as Mules, Suffolk cross Cheviot, Belclare cross and Hilltex within the county. There is potential to develop a market for these types of females that are already in demand by lowland producers seeking quality prolific replacements.

Table 2. Potential breeding strategies for hill flocks at different levels of output

Lambs reared per ewe joined	Pure breeding (%)	Crossbreeding (%)
0.80	66	34
0.85	62	38
0.95	56	44
1.00	53	47
1.05	50	50
1.10	48	52

Source: Adapted from Lynch 2012

An example of the potential of these sales is consistently highlighted in Mayo, with Producer Group sales of Mayo Mules and Greyface females held each year. Ewe lambs command premium prices at these sales. Similar developments are now occurring in Connemara, Sligo and Donegal. It is reasonable to assume a similar type of demand with consequential price improvement for Kerry and West Cork producers. Increasingly, at these sales, lambs are being offered for sale that are already vaccinated against the clostridial diseases and against pasturella pneumonia. Linkages can also be established between the primary producer and the lowland farmer which will be to the ultimate benefit of both.

Producer groups

As outlined previously there is significant scope to establish producer groups not only to market prolific crossbred ewe lambs but also to market hill and crossbred males and hill ewes. By organising and promoting specialised, sales the producer groups can develop direct links between producers and prospective buyers thereby facilitating on-farm sales. As flock biosecurity is becoming an increasingly important issue for many purchasers, the purchase of sheep directly from known sources rather through marts will become a preferred option for many purchasers. Frequently, these potential buyers are annual repeat purchases from the same flock. In addition, many purchasers including store lamb finishers are now anxious to acquire and are willing to pay extra for sheep that are vaccinated and are known high health status. Therefore, the establishment of producers groups to assist with the marketing of hill and crossbred lambs has significant potential. The challenge is: who are willing to establish and run these groups?

Hill land management

Hill sheep have an important role in the agricultural industry and in maintaining the fabric of many rural communities. However, their role goes further than mere production as they form a vital part of the management strategy to maintain valuable natural habitats. Aside from the environmental considerations this also has a knock on impact on other sectors such as the tourist industry, which is particularly relevant in Co. Kerry. The issue of over / under-grazing of hill and commonage areas with consequent risk from wild-fires has been well documented in recent years (Casey & Nugent, 2014). One way of reducing or managing this risk is by sustainable grazing management of these upland areas (Byrne et al., 2017). Studies from Northern Ireland (McCloskey 2016) have shown there is variation in the grazing behaviour of different breeds of sheep in these harsher environments. Perhaps unsurprisingly pure hill breeds such as the Scottish Blackface were found to travel further and to higher regions than their crossbred counterparts. Therefore, in the coming years its vital to maintain productive hill flocks.

Discussion groups

There has always been an active calendar for sheep meeting's and events in Co. Kerry. However, since the introduction of the Sheep Technology Adoption Programme (STAP) in 2012 the number of hill sheep discussion groups has increased. This has continued through the new Knowledge Transfer Programme. Currently, there are 11 active sheep discussion groups in Kerry with 10 of these predominantly comprised of hill sheep farmers. Discussion groups are a key method of delivering knowledge transfer to farmers. These groups are being facilitated by Teagasc and offer farmers an opportunity to engage with each other on key issues they face in running their own sheep enterprises.

BETTER Farm Sheep Programme

Teagasc currently has five hill sheep farms in the BETTER Farm Programme in counties, Cork, Wicklow, Mayo Sligo and Donegal. These are ordinary hill sheep farmers that are aiming to improve their hill sheep enterprise focusing on areas within their control such as flock management and health. These farms have consistently shown that improvements and productivity and profitability are possible by making simple changes to their farming system. The farmers are willing to host to visiting discussion groups to allow them see the systems in place on the farms and share their experiences.

Hill sheep recording

Almost 24% of our national flock of 2.5m ewes are upland breeds. By sheer impact of numbers, hill sheep have a huge potential contribution to make to the maternal genetics of Irelands sheep industry. Unfortunately, the level of performance recording taking place within hill breeds is very low and decreasing at present. The graph below

illustrates the low numbers of hill lambs recorded on the Sheep Ireland system with most hill breeds displaying a downward trend in recordings over the last 3 years. Of course there are difficulties with recording hill sheep data. These practical difficulties begin at mating time, where controlled single sire mating -that enable a sire to be identified – can cause logistical problems. Outside lambing with less supervision compared to lambing indoors also makes recording difficult, as it can prove difficult to physically catch lambs and ewes to insert identity tags and record the identity of the ewe in question. Notwithstanding the difficulties involved the potential benefit to the Hill Sheep industry of advancement in desirable breed characteristics through performance recording cannot be overstated.

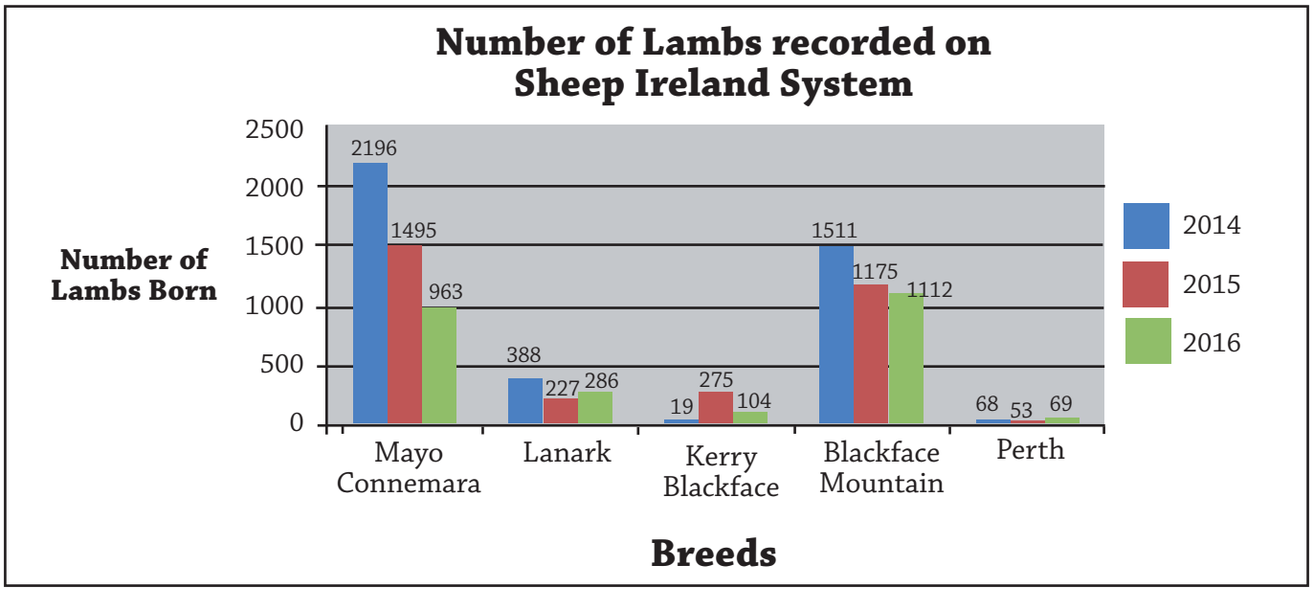


Figure 1. Number of lambs recorded on Sheep Ireland System 2014-2016 for different hill breeds. (Sheep Ireland).

However parentage data is the most important first step as performance recording of lambs will serve little benefit if it can't be related back to its parents. The true benefit of performance recording can only be realised by combining the performance data of siblings, parents and all other relations to an individual animal. Where rapid breed improvement can take place it is through the use of genetically superior (for desirable traits) rams. Genetic improvement through the use of genetically superior rams is up to three times greater than the improvement achieved by female selection on its own. But to achieve this, a big increase in recording parentage and performance of progeny is required.

Even on a small scale if hill sheep farmers were to select and mark a small number of their best performing ewes prior to single sire mating it would be a significant first step. Sheep Ireland would be pleased to assist farmers with this selection and recording. Addressing hill breed issues such as low fertility (nationally only 80%) and poor mothering ability have obvious economic benefits for hill sheep farmers. Lamb performance recording will lead to Euro-Star figures for hill rams and allow farmers to pursue genetic diversity and improving quality in their flock when purchasing rams. For lowland producers, using higher genetic merit rams in their flocks has resulted in significant performance benefits. Briefly, these are:

- Lower lambing difficulty
- Better lamb survival
- Improved growth rate
- More productive females

It will also be possible for hill farmers to exploit these same benefits. However, if this is going to be achieved for pure hill breeds one of the major limiting factors that need to be addressed first is the absence of flock-books with parentage records. Although it must be acknowledged that the environment in which these flocks operate provides

a number of practical limitations with collecting this type of information, but it is not an insurmountable task. For example, each seasons full EID recording from birth has been possible on the BETTER farm hill flocks. Within each seasons lamb crop, over 50% of lambs produced have parentage records. These have been developed as a result of periods of single sire mating in the autumn. However, for most flocks this will prove unrealistic. Therefore, for the hill breeding industry to move forward efforts must be focused on specific areas. Central to this is the involvements of ram breeders who are providing the breeding stock for the hill farmers.

Potential of finished hill lambs

Large numbers of hill store lambs are produced for sale in the Southwest from August onwards. These lambs are typically finished over the autumn and winter months and have a significant role in the continuity of supply of lamb to the market especially in spring. The production of early born (spring) lambs specifically for the Easter market has become challenging over the last number of years and finished hill lambs have now acquired an important role in meeting market requirements at this time of year. On most hill farms both the quantity and quality autumn grass is scarce with many competing demands for it. Hill sheep farmers must weigh up the option of allocating grass to finishing lambs versus making this grass available to flush hill ewes in the autumn. Often in this region, due to limited areas of improved grassland, many hill sheep farmers are not in a position to profitably finish hill lambs without adversely affecting the performance of the breeding ewe flock. A significant proportion of the store lambs produced in the Kerry / Cork region are sold to finishers in the midland and east of the country and finished on these lowland farms.

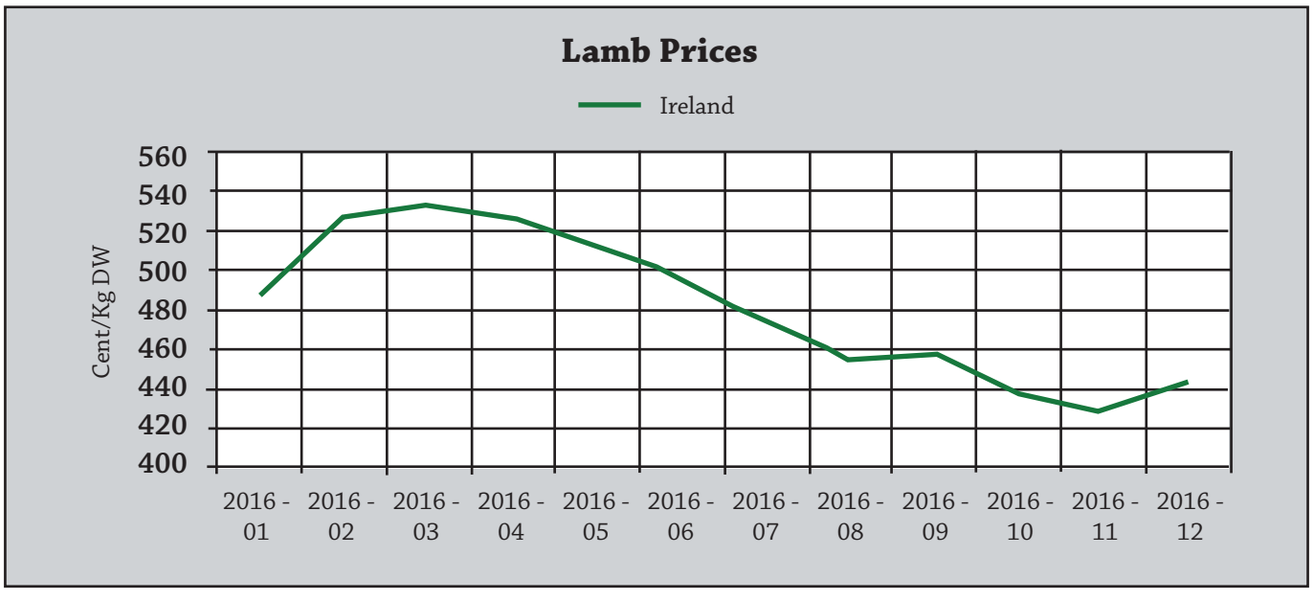


Figure 2. Monthly lamb price trends cents/kg DW 2016 (Bord Bia).

The above graph displaying lamb prices in Ireland in 2016 indicates price increases from €4.90/kg/DW in January to €5.30/kg/DW in April. These improved prices influence the profitability of store hill lambs finished during this period. Looking at historical price information the optimum time to market finished hill lambs appears to be from late February to early April.

Teagasc have carried out a number of case studies for finishing lambs which are summarised in the Table 3 below giving performances for (1) very light mountain lambs - 20kg (2) lightweight lambs - 25kg, (3) medium weight mountain lambs - 29kg and. It is apparent that that a margin can be made on finishing hill lambs on a combination of autumn grazing and then finishing on an all concentrate diet, especially if they are significant numbers and that there is a significant rise in finished lamb prices as described above. There is undoubtedly potential for more lowland farmers to enter the finishing store lamb enterprise and create more competition and demand for store hill lambs. This can only be of benefit of hill producers with increasing profits resulting in increasing ewe numbers and more viable holdings. Increased promotion of the hill lamb finishing enterprise to new entrants accompanied with knowledge transfer relating to husbandry of hill lambs would assist in this.

Table 3. Performance of very light (20kg), light (25kg) and medium weight Scottish Blackface ram lambs (based on conc. Price €260/tonne)

	Very light weight Mountain lambs (~20kg)	Light weight Mountain lambs (~25kg)	Medium weight Mountain lambs (~29kg)
Purchase Price € (€1.75/kg)	20.035020200	43.7543.75	50.75
Date of purchase	20 August	20 August	20 August
Date at housing	1 December	1 December	1 December
Housing weight (kg)	26.4	31.4	35.4
Concentrate intake (kg)	114	88	68
Concentrate costs (€)	29.72	21	17.60
Sale Date	4 March	12 February	27 January
Target Weight (kg)	21.0	21.0	21.0
Sale price (€/kg)	4.75	4.75	4.75
Sale weight (kg)	47.7	47.7	47.7
Sale price (€)	98.43	98.43	98.43
Margin €	12.37	10.53	9.07

Increasing factory lamb prices to €5.20 / kg would increase the margin to €21.82, €19.98 and €18.52, for very light, light and medium above, respectively. A further critical factor affecting the margins on finishing hill lambs is the amount of liveweight gain achieved at grass during the autumn and early winter.

Summary

The hill sheep sector plays a vital role in the Irish sheep industry particularly in Kerry and West Cork in terms of production and the vital role they play in maintaining the natural habitat. With the scale of the hill sheep sector in Kerry and West Cork there is great potential for farmers to work together in producer groups to develop markets for the lambs they produce through organised breeding sales and as a point of contact for direct farmer to farmer sales. These have been shown to be highly successful in other regions. Previous experience has indicated that this approach will require commitment from a dedicated group of local stakeholders to drive this process forward. There is scope for breed improvement with the potential to make real gains that will benefit farmers. The initial steps have been taken through the efforts of Sheep Ireland, breeders and local Teagasc personnel. To drive this process forward more hill farmers need to get involved and participating in the process. Like all sectors it can be difficult to predict where it will be in 5-10 years' time it is important to provide information and knowledge to those who will be farming the hills in the coming years.

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Farming the Uplands -Where to from Here?

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Take home messages

- Timing of grazing and number of grazing days on uplands is critical to sustainable management
- Economic returns is the main driver for grazing the uplands
- Income from all schemes (BPS, ANC, Greening and GLAS) should be included when examining the economics of hill sheep, to advise and lead hill sheep farmers in the correct direction as these payments could become dependent on farmers grazing the uplands.
- Farming the uplands is the only way to manage the uplands to achieve the three pillars of sustainability - social, economic and environmental.
- Locally Led Agri-Environmental Schemes should be seen as an opportunity to trial new innovative ways of dealing with upland farmers and providing financial aid that will actually result in sustainable management on the uplands into the future.

Introduction

In 1975 the Less Favoured Areas (LFA) scheme was introduced in Ireland as part of the Common Agricultural Policy (CAP). Farmers in these areas were eligible to receive payments per head for livestock including cattle and sheep. The main aim of the scheme was to provide a reasonable level of income to farmers who farmed in areas with natural disadvantages (MacDonald et al., 2000). However, overgrazing in the upland regions became an issue in the early 1990s mainly as a consequence of increased stocking rates that ensued following the introduction of headage payments (Buckley et al., 2009; Acs et al., 2010).

Commonage Framework Plans (CFP) were introduced in 1998 in order to address the issue of overgrazing. Over 4,000 CFPs were drawn up and required all commonage farms to farm according to the specifications of the plans and to undertake compulsory destocking on all commonages (Buckley et al., 2009). In 2005 the introduction of decoupled payments under the Single Payment Scheme (SPS) also reduced the incentive to put sheep onto commonage land (Van Rensburg et al., 2009).

At present the traditional agricultural activity of hill sheep farming is in decline. Stock numbers on commonages have being falling significantly over the past 15 years and will continue to do so into the future if the current problems are not addressed. Department of Agriculture Food and the Marine records show that currently only 8,500 commonage farmers have sheep and of those, only 6,000 actually have mountain breeds such as the Scottish Blackface or Wicklow Cheviot. While some cattle do graze commonage, there appears to be many farmers currently claiming direct payments on commonage under the Basic Payment Scheme (BPS) who are not grazing these areas. According to Monaghan (2015), 50% of farmers who declared commonage on their SPS applications never actually used it. In order to qualify for BPS, Greening, Green Low-Carbon Agri-Environment Scheme (GLAS) and Areas of Natural Constraint (ANC), these areas require the continuation of active farming and are likely to be deemed ineligible for future payments unless farming practices change, such that commonage land is maintained in Good Agricultural and Environmental Condition (GAEC). It is worth noting that farmers can receive BPS and Greening on commonage land even where they don't have sheep provided the land is maintained in GAEC. However it appears inevitable that vast tracts of commonage will become ineligible due to low levels of farming activity. This will financially affect both shareholders not using the commonage and also those who currently use it. Consequently, there is a danger that these areas will become completely abandoned because market returns from hill sheep production are not economically justifiable in the absence of income supports.

Wicklow uplands study

In 2015, Teagasc completed a study with farmers in the Wicklow Uplands to quantify what farmers were actually doing with their upland areas and the reasons why. From a potential population of 317 farmers who have access to commonage, selection of farmers was guided by those who had an existing relationship with Teagasc. Interviews of approximately one hour were conducted with 60 farmers at their residence. Table 1 gives the age profile of the farmers which does not differ significantly from the age profile of the general population of Irish farmers. However, the CSO (2010) found that 6.2% of farmers were under the age of 35 whereas in this study's population no farmers under the age of 45 were found.

Table1. Age of farmers who participated in the survey.

Age	Number of respondents	% of respondents
Under 39	0	0%
40 – 49	10	17%
50-59	29	48%
60 – 69	16	27%
70+	5	8%

Of the 60 respondents, 57% were full time farmers with 43% operating their farms on a part time basis. A total of 60% of the farmers were in either the REPS or AEOS agri-environment scheme. Average commonage share was 51 ha on an average total commonage size of 305ha. The amount of private land owned averaged 32 ha. The number of shareholders on a commonage varied from two to 21 with an average number of eight.

Current levels of activity on the uplands

Table 2 shows that while all the farmers in the survey were declaring the land as forage area for payments, only 41% of the farmers in this study actually grazed any stock on it. This compared to 83% who were grazing it in 1999 (15 years earlier). Table 2 also shows that farmers are now grazing the uplands for a shorter period of the year, with only 18% of farmers grazing these areas for 6 months or more (compared to 70% in 1999). Six months (+) grazing would be regarded as traditional practice in the area and is now a requirement for participation within GLAS.

Table 2. Farmer use of the upland.

Year	Farmers declaring upland for Agri schemes	Farmers actually grazing the upland area	Farmers grazing the upland up for 6 months or more
2014	100%	41%	18%
1999	100%	83%	70%

The study also found that between 1999 and 2014, 66% of the farmers had either reduced their numbers of sheep grazing the uplands or stopped grazing altogether, and a further 16% had done so in the 5-10 years previous to 2014. Table 3 shows the dramatic drop in sheep numbers grazing the uplands, but especially in the early summer and winter periods. This study shows that while there are fewer farmers using the uplands than in the past there has also been a very big decrease in the numbers of sheep and the length of time they spend grazing on the upland areas than just looking at farmer numbers alone would suggest.

Table 3. Sheep numbers grazing upland areas in 2014 and 1999 and % change.

Time of year sheep spent on commonage	2014	1999	% change
Ewes and lambs on hill (May-July)	856	5082	-83%
Ewes on hill after weaning (Aug-Oct)	3822	8312	-54%
Ewes on hill after Mating (Dec-Feb)	1602	4832	-66%
Dry ewes and hoggets (February-July)	1238	2377	-47%

Reasons for reduction in sheep grazing the uplands

The next important question is why there are now fewer sheep grazing the uplands. Table 4 lists all the reasons given by the farmers in the survey (some similar answers were grouped together).

Table 4. Reasons given by farmers for, why they graze less sheep on the uplands.

Reason	% of farmers who mentioned this reason
Sheep losses on the uplands	43
Poor economic return	43
Reduced lamb performance	33
No market for light hill lambs	29
Smaller lamb crops	18
Hills are overgrown	18
Farmer was told to destock	15
Farmer keeping less stock & doesn't need the grazing	11
Labour issues	9
Age	4

The top five reasons quoted by farmers for putting fewer sheep to the uplands all relate either directly or indirectly to economic return. Age was not seen by the farmers themselves as a major reason for not putting sheep to the uplands. Similarly, labour was not regarded as an issue, but the study found a direct relationship between off-farm employment and grazing the uplands, with 58% of those with no off-farm employment putting sheep to the hill compared to just 27% of those with off-farm employment. There was no relationship between age, area of upland, area of enclosed holding or even being in an agri-environmental scheme (AEOS or REPS) and grazing the uplands.

Current levels of output from the uplands

Table 5 indicates that there are greater losses of ewes on farms that graze the uplands and there are a significantly lower number of lambs weaned. The study also found that the more time spent grazing the uplands, the lighter weight the lambs are sold at. This study did not examine costs or profitability on the farms, but Teagasc e-Profit Monitor results for 2015 show a gross margin from hill sheep €30 per ewe, and a net margin of €0.

Table 5. Usage of commonage and lambs weaned per ewe.

	No longer using Commonage	Only grazing ewes after weaning	Grazing ewes & lambs and weaned ewes
Ewe losses	3%	11%	11%
Lambs weaned per ewe	1.35	1.24	0.92

Condition of vegetation

Almost all of the respondents (93%) stated that heather had increased on their commonage in the last 15 years. The majority of farmers (63%) stated that bracken cover had increased on their commonage while 22% of respondents felt that the proportion of grassland had decreased on their commonage. Table 6 presents the reasons the farmers gave for the vegetation changes on the commonage (answers grouped under four main headings). Lack of burning was regarded as by far the biggest issue, with reduced grazing being the only other issue they raised.

Table 6. The factors that have led to commonage being in this condition.

	% of Respondents
No burning of vegetation on commonage	89%
Less sheep grazing commonage throughout the year	58%
Less sheep in early summer grazing commonage	40%
Less sheep grazing on commonage in winter	14%

Where to from here?

A guiding principle to meet sustainability goals within FoodWise 2025 will be that environmental protection and economic competitiveness be considered as equal and complimentary; one will not be achieved at the expense of the other. The three pillars of sustainability – social, economic and environmental – are equally important and carry commensurate weight. FoodWise 2025 Strategic Environmental Assessment Report recognises under-grazing as a threat to Natura 2000 sites. These lands offer key values in terms of quality and an opportunity for Ireland's agricultural produce to be linked to and marketed as a high-end environmentally sustainable product. Farmers with Natura uplands (Special Areas of Conservation) are obliged to maintain their uplands in Favourable Conservation Status. Article 6(2) of the Habitats Directive sets out the requirements of Member States, that within European sites, they maintain and restore those habitats to Favourable Conservation Status (FCS). While there are currently areas of undergrazing and overgrazing, overall the priority for the future must be to increase farming activity on the upland areas in order to keep these areas in a suitable agricultural and environmental condition. This will involve increasing numbers of grazing animals on the actual upland areas and vegetation rejuvenation in some areas.

Management of the uplands

Grazing uplands at a sustainable level is the ideal management for farming and biodiversity. Intervention to rejuvenate overgrown vegetation should only be considered if it is the plan to follow this with a sustainable grazing programme. A combination of control options may be required. Consultation with the National Parks and Wildlife Service (NPWS) is necessary if carrying out work (Activities Requiring Consent) in Natura areas. A study to identify Best Management of Upland Habitats in County Wicklow was carried out by Tubridy et al (2013). Some of the plant species that may require control in upland areas, discussed in the study are outlined below. Teagasc organised two events in Wicklow in 2016 to demonstrate and discuss Prescribed Burning and Mechanical Management, engaging with all interested stakeholders.

Purple moor grass (*Molinia caerulea*)

Purple moor grass is often called white grass in Wicklow; fedget grass in parts of Kerry; meelic from its habitat marsh place or milic in Irish; and by its Irish name Fionán. It can dominate large areas of blanket bogs. The name purple moor grass comes from the purplish tinge of the plants early in the season. According to the Grasses of Ireland (2012), Molinia grasslands can be recognised by the shiny look of a mountain on a windy day and were considered valuable, compared to the reddish coloured vegetation that indicated a dominance of cotton-grass, which had a lower rental value.

Purple moor grass grows in tussocks and at the end of the growing season, an abscission layer at the base of the leaves similar to deciduous trees, results in the leaves breaking (Feehan et al., 2012) Where grazing levels are low, the leaves shed in autumn build up producing a dense litter layer. This has the potential to smother out other species; hence it is important to prevent such a dense layer from building up. Cattle are more likely than sheep to eat purple moor grass. In addition to grazing levels, timing of grazing is critical for the sustainable management of this species. Purple moor grass has a high grazing value, but only in spring and early summer, whereafter digestibility drops off quickly. Dead material remaining over the winter has negligible nutritional value and is relatively indigestible. Good examples of Purple moor grass dominated habitat will contain other plant species, a habitat for the rare and protected marsh fritillary butterfly *(Eurodryas aurinia)* or potentially nesting sites for wading birds. Poor examples of this habitat will be dominated by purple moor grass to the exclusion of most other species. Abundance of this species tends to be associated with a reduction in cattle grazing or too frequent burning. As purple moor grass is a fire tolerant species, burning exacerbates the problem.

Bracken (*Pteridium aquilinum*)

Bracken dominated areas are poor for farming and biodiversity in general and tend to harbour ticks. Bracken is toxic to animals MAFF (1984), and spores contain carcinogens. The presence of bracken also increases the rate of soil or peat erosion. A reduction in cattle grazing and particularly hot frequent fires can enhance the growth of bracken. Asulam (Asulox) is a selective herbicide for the control of bracken. Applied in mid-July to mid-August, it is very effective in killing bracken (average of 98% reduction). A follow up treatment in the second year may be required. Asulam kills all species of ferns and some other plants which may be of importance.

Asulam did not gain EU approval in 2011 and consequently DAFM (as well as the UK authorities) have issued an

emergency approval each year since, for the control of bracken in upland areas, for a limited time period (120 days each year). This 120 day period usually commences around June. It is hoped that by 2018 a full (new) authorisation will be in place, when Asulam gets EU approval. Until then the only option is the emergency approval route.

Glyphosphate is a non-selective herbicide and therefore and kills all plants it contacts. It may be used with a weed wiper to target bracken early in summer before plants get too tall to operate in. A second application may be needed in order to control all the bracken plants, including those that were too small at the time of the first application. Cutting/crushing can be useful in getting rid of bracken. It needs to be carried out twice per year, in late June and in Early August, each year for 3 years. On upland sites, because of nesting birds, cutting is not allowed until after the 31st August, so this method alone will not be an option.

Burning in general, speeds up the spread of bracken as the rhizomes are better able to withstand fires than more shallow rooted plants such as heather. But burning does break the dormancy of the rhizome and removes the build-up of decaying bracken plants. This method should only be used as a pre-treatment to other methods such as herbicide application.

Heather (*Caluna vulgaris*)

Where heather is present, the ideal situation for farming and biodiversity is a mosaic of heather and grassland with a good distribution of heather of all ages. If the age distribution is too skewed towards old heather and all grassland areas are lost to a full stand of heather, this is not good for farming or biodiversity. Prescribed burning, in patches, of tall strong heather is recommended, in accordance with the DAFM Prescribed Burning Code. Burning is only recommended when followed with sustainable levels of livestock grazing. Mechanical cutting of heather can be used to make fire breaks and fire control lines for prescribed burning at a later date. For effective fire breaks, vegetation must be cut immediately prior to burning or the cut material removed before burning commences. Vegetation takes about eighteen months to rot down to be suitable as a fire break, if not removed. Cutting out lines of heather can facilitates the planning of patchwork burning.

Gorse / Furze / Whins (*Ulex europaeus*)

Mechanical control of gorse involves the physical removal of the bushes with an excavator, including the roots. This removes existing plants, but others grow back from seed. Bushes are usually heaped in mounds and burned or left to rot. This causes a lot of disturbance to the soil and may not be desirable or allowed on upland or SAC areas. Follow-up treatment is often necessary. Mulching with either a tractor- or excavator-mounted machine chops the plants down to ground level, leaving stumps behind. There are no plants to dispose of, as they are mulched up, but regrowth from the stumps usually occurs, and plants also grow back from seed.

Cutting and stump treatment involves cutting the bushes as low as possible and painting the stumps with a suitable herbicide (Glyphosphate or Grazon 90) immediately to kill the roots. Cut plants have to be removed and heaped in mounds for rotting away or burning. Cutting is usually done using a chainsaw and is quite labour intensive, but may be an option on smaller areas of mature growth. There is no regrowth from treated stumps and with no ground disturbance, seed germination is minimised.

Herbicides can be used to kill mature gorse plants and there are a number of products available. Glyphosphate is non-selective and will kill all plants underneath, while selective products only kill gorse and allow other vegetation underneath to establish. There is still a lot of woody material left behind that takes a long time to rot away. Apply during active growth, generally early summer and ensure the entire plant is saturated. Use a suitable surfactant (wetting agent) to increase herbicide uptake. Herbicides can be used to control new regrowth following any control method. Regrowth is easier to kill and should be treated approximately 12 months after initial control. A selective herbicide for gorse should be used to avoid non-target competing plants.

Feehan (2013) discusses the burning of gorse, which kills the above-ground stems and leaves entirely if sufficient heat is generated, though gorse seeds germinate with great ease in the bare ground under bushes that have been burnt. Burning is not recommended if the bushes are young as it will stimulate the growth of a forest of young shoots at ground level or from the bases of the stems. As gorse gets older the stems can be as much as 0.3 metre across, and it becomes less able to produce adventitious buds from the base if it is cut or burnt. Burning is a more effective way of clearing mature bushes over fifteen years old. Gorse regenerates prolifically from the seed bank after a fire, and ideally should be kept under control by grazing. The young fresh regrowth which follows burning is very sensitive to herbicides. Repeated burning without follow-up treatment can lead to a dense carpet-like infestation.

The best time to burn is between September and November, avoiding the bird-nesting season and also avoiding January-February which results in increased seed germination.

Economic returns

The main reasons given by farmers in the Wicklow study for reduced sheep grazing on the uplands related to economic returns, so that should be the first issue to be addressed. It has been suggested that there should be a price premium for lambs that were produced from the upland areas based on the environmental benefits to habitats/biodiversity, operated through local hill lamb schemes. This requires much work in setting up and marketing, but could definitely be a long-term option for increasing the profitability of hill sheep farming.

Teagasc profit monitor results for 2015 show hill sheep have a gross margin of €30/ewe, and a net margin of €0/ewe. However, when examining the income from hill ewes, all forms of income should be taken into account, including agricultural and agri-environmental payments received by farmers, i.e., BPS, Greening, GLAS and ANC. When the Single Farm Payment was replaced by the Basic Payment Scheme and the Greening Payment in 2015, entitlements are subject to convergence towards 90% of the 2019 national average. By 2019 all entitlements will have a minimum value of 60% of the national average value. This will result in large increases in money paid to farmers with upland areas, where payments were traditionally low. To put this into perspective and using the data from the farmers who were part of the Wicklow study is set out below. Average area of lowland was 32ha which is roughly the maximum area for payment under the ANC scheme, so it could be drawn down on the enclosed area alone without farming any upland area. The average area of upland/commonage was 51ha, and with an average the GLAS payment of €5,000 over the whole upland area, the average GLAS payment per hectare is of €98. For BPS and Greening, at 2019 rates, this is €150/ha. This gives a payment from BPS, Greening and GLAS on the upland area of €240 per ha.

DAFM Minimum Stocking Rate (SR) on upland areas varies according to the carrying capacity of the land and is available on the Commonage Container on DAFM website. Examples below calculate scheme payments per ewe for 2 hills with different carrying capabilities.

Scheme Payments on upland area = €240 per ha

- If DAFM Minimum SR is1.4 ewes/ha on the uplands – Scheme Payments = €171/ewe
- If DAFM Minimum SR is 2 ewes/ha on the uplands – Scheme Payments = €124/ewe

Because farmers have been receiving payments under BPS and agri-environment schemes on upland areas without putting stock there themselves (provided grazing by some stock occurred) they do not see these direct payments as income from the hill sheep. If farmers must be actively farming the uplands to be eligible for BPS, ANC and GLAS, then this income can be attributed to ewes grazing on the upland area, which make them very profitable.

Collective farming

Uplands are predominantly unenclosed, both commonage and privately owned land. Traditionally, farmers worked together herding sheep, gathering, burning, etc., and controlled the numbers of sheep grazing on the uplands in most areas. As farmers moved away from grazing the uplands, this co-operation has diminished. Previous agricultural and agri-environmental schemes have dealt with commonage farmers as individuals, despite the fact they do not farm in isolation from other shareholders. GLAS addresses uplands at commonage level, but deals with individual farmers subject to an overall commonage plan, and can have as little as 50% of the farmers on a commonage in the scheme. Dealing with farmers collectively is key to achieving long-term sustainability on the upland areas both for biodiversity and for farmers. In the Wicklow study, 82% of respondents indicated that setting up a commonage group to discuss management of the commonage would be beneficial to shareholders, with 47% felt that these groups could be used to join agri-environmental schemes in the future. Interestingly, 94% felt that inactive shareholders should also be members of these groups. The new Locally Led Agri-Environmental Schemes currently being developed are an opportunity to examine options for uplands specific to local areas rather than national options designed to target all.

Future research / Demonstration

In the report on the review of Commonage Lands the Oireachtas Joint Committee on Agriculture, Food and the Marine (2013) recommended that studies be undertaken to assess the effect of changing farming methods, particularly the supplementary feeding of ewes and hoggets, on patterns of under and overgrazing. Tubridy et

al. (2013) identified a need for research on grazing regimes to maximise productivity and benefit biodiversity in upland habitats. Applied research to develop advisory guidelines for farming in the hills on grazing, burning / swiping and the treatment of bracken and purple moor grass is also required. A blueprint for hill sheep farming which maximises the profitability and provides sustainable grazing levels is required. A proposal to investigate upland grazing practices through the Teagasc BETTER Sheep Farm programme is being developed. This will focus on management of the upland areas and how they are integrated into the whole farm.

Relevance of Wicklow upland study to other areas

There is considerable variation between uplands throughout the country, with varying proportions of blanket bog, wet heath, dry heath and upland grasslands; as well as variations in farming system, farm size and socio-economic factors. In 2015, as part of Teagasc Commonage Management Planning In-Service Training for FRS advisers, discussions with farmers on the Comeragh Mountains in Waterford identified worrying trends similar to the Wicklow study of less ewes and lambs grazing the hill in early summer. While it is recognised that overgrazing is still an issue to be addressed in places, the current overriding concern is the threat of reducing farming activity in the uplands. Both undergrazing and overgrazing occurs in every upland region and often within the same commonage. The Take Home Messages from the Wicklow study have relevance for every upland region.

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A Scottish Perspective to Improving Hill Sheep Productivity

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Take home messages

- Hill sheep production is an important part of the Scottish economy in terms of production outputs, landscape and biodiversity maintenance and its associated influences on many rural communities.
- Genetic selection can provide significant improvements.
- New technologies can provide opportunities to improve productivity and reduce costs.

Introduction

Hill sheep production is an important part of the Scottish economy in terms of production outputs, landscape and biodiversity maintenance and its associated influences on many rural communities. The industry is facing a number of challenges, particularly in the wake of recent political uncertainty and the potential consequences this may have on future subsidy support upon which many hill flocks rely heavily. Generally, productivity in many hill flocks is low, due to constraints such as poor grazing quality, topography and climatic conditions. Additionally, increases in the costs of fuel, feed, fertilizer, animal health treatments and labour, for example, mean it can seem difficult for some to see how any improvements in their productivity, and therefore profitability, could be achieved. However, there are a number of options that could be explored in which to help the productivity and efficiency of hill farms, whilst maintaining their important role within the rural economies and environments in which they are located.

Breeding to improve productivity

Currently, within the UK hill sheep production sector, a multi-trait selection index is available to producers, encompassing estimated breeding values (EBVs) for traits relevant for both maternal and lamb performance. Hill breeds have a complex role, influencing all sectors of the stratified UK sheep system, providing lambs for meat production and breeding ewes for both pure and crossbred flocks, therefore the inclusion of traits relating to both ewe and lamb performance is essential. Table 1 shows the breeding goal traits (those that we wish to improve) and the index traits (what we actually measure) included in the multi-trait index developed in the early 1990's and tested at two SRUC hill farms between 1999 and 2011: SRUC's Hill & Mountain Research Centre (HMRC), Kirkton farm, Crianlarich, in the Western Highlands, and Castlelaw Farm in the Pentland hills near Edinburgh. Each of the traits included were weighted according to their economic importance, with the overall index value for each animal being the combination of breeding values estimated for the individual animals themselves and their relatives (Lambe *et al.,* 2014).

Within the flock of ~600 ewes at each farm, three genetic lines of Scottish Blackface (SBF) animals were run together, consisting of a Selection line, a Control line and an Industry line, with approximately one third of all ewes in each line. Both Selection and Control line animals were kept as breeding stock according to their multi-trait selection index score. Animals in the Selection line with the highest index score were selected, while the Control line animals were selected to try to maintain an average index score. Industry line animals were selected on appearance only, currently the common practice used by many commercial flocks.

Table 1. Breeding goal and index traits included in the SRUC hill sheep selection index.

Ewe breeding goal traits	Ewe index traits	Lamb breeding goal traits	Lamb index traits
Mature Size	Pre-mating live weight	Lamb weaning weight	Weaning weight
Longevity	Age at culling or death	Carcass fat class	Ultrasound fat depth
Lamb Loss	Lambs lost birth - weaning	Carcass conformation	Ultrasound muscle depth
No. of lambs reared	Litter size at weaning	Carcass weight	
Av. weight of lambs weaned	Av. weight of lambs weaned		
Fleece weight	Fleece weight		

The results observed after 13 years of selection, in terms of the average index values for each line, are shown in Figure 1 for the HMRC flock. If the average index score is considered in monetary terms (pence), it can be seen that there was approximately a £4 and £2.50 difference, per ewe, between animals in the Selection line compared with those in the Control and Industry lines respectively in 2011. The selection index developed and tested at SRUC was the basis for the Hill-2 selection index currently available to breeders in the UK through the Signet Sheepbreeder service.

Additional traits of interest, such as lamb survival have also recently been investigated, using data available from performance recorded SBF flocks throughout the UK, recorded between 1976 and 2011. Significant influences included the flock, year, age of the dam, sex of the lamb, litter size born and birth weight. Birth weight is of particular interest, with studies previously highlighting the increased risks of mortality in SBF lambs with very low or very high birth weights, thus any steps to avoid these higher risk weights would be beneficial. The heritability estimated for lamb survival (ie. the strength with which the trait is inherited) was found to be 9%, indicating that genetic improvement for this trait was possible and would be worthy of inclusion in future selection indexes.

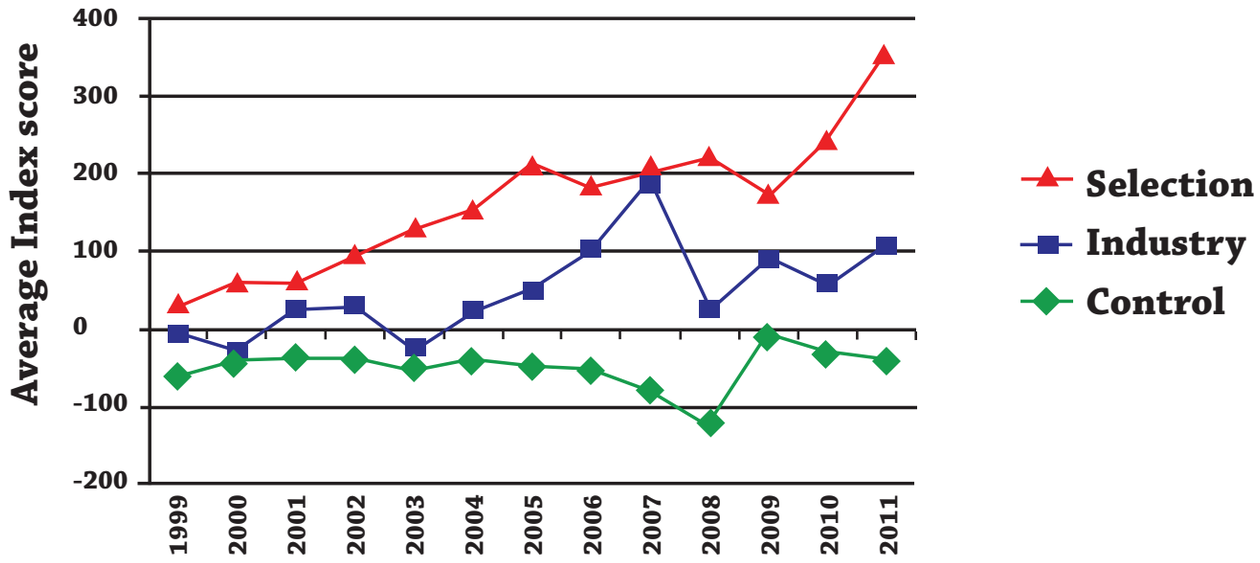

Figure 1. Average index values for the three genetic lines (Selection, Control & Industry)

Alternative breeds

Another potential option is to consider the introduction of additional/alternative breeds into hill systems. Work is currently underway at HMRC to assess the suitability of Lleyn sheep for a Scottish hill farm, by comparing their performance with that of the established SBF flock discussed above. The SBF flock has been reduced to two

lines (Selection and Control, n=300 in each line), which have been managed together with the Lleyns (n=300), throughout the annual reproductive cycle, since 2013. All ewes are recorded through the Signet Sheepbreeder scheme, with the highest index Lleyns being retained for breeding (similar to the SBF Selection line). Preliminary results have found that the Lleyn ewes have performed just as well as the SBF Selection line ewes, when reared in the same environment. Some specific results to date include significantly ($P<0.05$) greater litter sizes scanned, born and weaned by the Lleyn ewes when compared with the SBF Control line ewes, whilst no significant differences ($P>0.05$) were found between the Lleyn and SBF Selection line ewes. In terms of lamb losses, from scanning to lambing or from lambing to weaning, these did not differ significantly ($P>0.05$) between breeds (considering either SBF line). Total litter weights weaned by the Lleyn ewes was significantly greater than the SBF control line ewes ($P<0.05$) and comparable ($P>0.05$) to the SBF Selection line ewes. The average weaning weight per lamb reared by the ewe (total litter weight / number in litter) did not differ significantly between breeds.

The use of technology to improve productivity

There are also a number of emerging technologies which could prove useful to hill farmers in order to help them make more informed decisions and therefore improve productivity, ranging from electronic (EID) ear tags to DNA profiling. With the introduction of compulsory ear tagging there is an opportunity to identify, monitor and manage animals at the individual level. The ability to identify animals, using technologies such as hand-held EID tag readers, or EID tag readers attached to auto-drafters, allows improved decision making and reduced labour at many handling events. Common examples include drawing animals for slaughter, the identification of ewes to cull from the breeding flock and the selection of ewes for specific mating groups. However, there are also other opportunities which are currently being explored by SRUC. These include investigating the benefits of using information collected and stored using EID technology for making decisions on worming strategies and winter feeding levels.

The targeted selective treatment (TST) of individual animals, in relation to worming strategies, involves the identification (via EID) and treatment of animals failing to reach their individual target weight, using an approach developed by the Moredun Research Institute, UK and Lincoln University, NZ, known as the "Happy Factor" algorithm (Greer *et al.* 2009). Those that achieve their target weight do not require treatment. This method was compared to a more conventional method (CON) of worming, based on pooled faecal samples, where groups with faecal egg counts (FEC) above or below 500 eggs/g were treated, or not, respectively. Lambs were weighed monthly, throughout the summer, and treated depending on their growth rates (TST) or pooled FEC counts (CON). After two years of this comparison the results indicated that the TST strategy was helping to reduce anthelminthic use without causing any detrimental effects on lamb growth rates, thus reducing the rate of resistance build-up and the costs associated with labour the wormer products used. A similar approach, testing strategies for allocating ewes to appropriate feeding level groups, is also under investigation in order to maintain, or avoid damaging loss, to ewe condition during the winter months.

Increasing developments in DNA technologies also offer potential opportunities for hill farmers in the future. Many Scottish hill systems use multiple sire mating groups and lamb on the open hill, therefore it is difficult to establish just how different individual rams (and ewes) perform. It also means that it can be difficult to become involved with breeding schemes due to the lack of reliable pedigree information. Since 2012, DNA samples have been collected from all SBF rams, ewes and lambs based on the commercial, non-performance recorded Auchtertyre hill flock at SRUC's HMRC. The DNA samples are submitted to Zoetis for analysis using their "Shepherd-Plus" parentage test. The accuracy of the results have been promising, with 98% of lamb samples submitted in 2015 being matched to a sire and dam. The costs are currently a potential barrier for the uptake of this technology in the short term, but should they reduce in the future, there is scope for uptake. The technology has enabled the identification of differences in the number and performance of lambs sired by each ram, thus allowing us to identify those producing higher value lambs compared to their contemporaries. It also allowed a small demonstration study of the effectiveness of using sires with EBVs on a non-recorded hill flock. The relationship between average lamb weaning weights in 2012 (n=220) - after adjusting for the effects of: ewe age; ewe weight and condition score pre-mating; the sex of the lamb; and the size of the litter in which the lamb was reared – and the EBV of the lamb sire, is shown in Figure 2. As the EBVs of the sires increased so did the average weaning weight of their lambs. Although it must be emphasized that this was only a small study, it does demonstrate the influence that using sires with EBVs on a non-recorded hill flock can have.

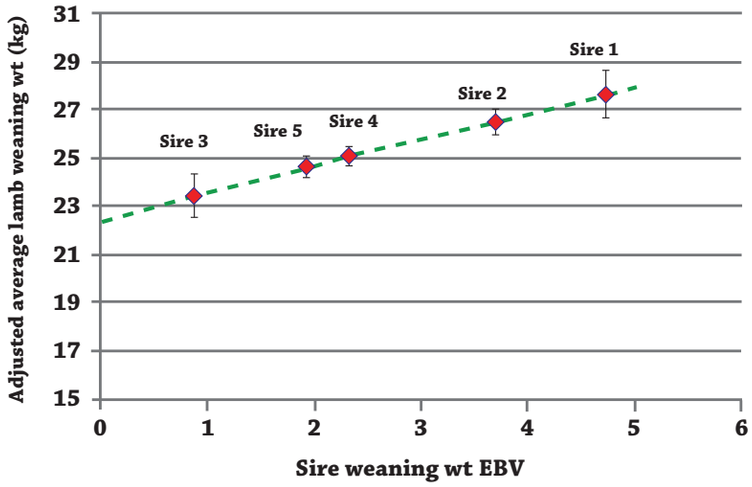

Figure 2. Effect of Sire estimated breeding value (EBV) on average lamb weaning weights

Addressing disease issues to improve productivity

One important disease, responsible for a high proportion of lamb losses in hill and upland regions, is hepatogenous photosensitisation, often referred to as "yellowses". The prevalence is highest in extensive grazing systems, such as those found in hill and upland regions of the UK and north western Europe, in areas associated with the long-lived, perennial plant known as Bog Asphodel (*Narthecium ossifragum*) (Pollock *et al.*,2015). In a recent SRUC survey of 36 farmers who reported having experienced "yellowses" in their flocks, those worst affected during a bad year observed up to 50% of their lambs affected, with the most affected region being North West Scotland (average of 16% incidence). With the removal of the plant being impractical, it is therefore important to explore other avenues in order to combat the negative relationship that seems to exist between the plant and the animal. Visible clinical signs of the disease include the development of lesions, predominantly on the ears, face and sometimes along the back of the animal which can lead to secondary infections and death. Liver disease is also associated with the disease and can cause ill thrift, predispose lambs towards other infectious and metabolic diseases and have a negative effect on the growth and general quality of life of those affected. In addition to having an adverse impact on lamb productivity, the disease also represents a major animal welfare concern. The low numbers of lambs with overt physical clinical signs and year to year variation creates challenges in studying diseases of this nature. In a preliminary study of the impact the disease can have, using lambs based at HMRC, in 2014, weaning weights for surviving lambs with clinical signs were 3.1kg lighter than their half-siblings with no clinical signs. Clinical signs were evident in 20% of the hill lambs present in June 2014, of which approximately 30% were not seen again when the lambs were weaned in August-September. In 2015, a low incidence of clinical signs, but high unaccounted lamb losses, were observed. Similar mortality rates have been noted in a SAC Consulting study of "blackloss" on commercial hill flocks, where "yellowses" was noted as one of the prime candidates for lamb disappearance. It is hoped that this disease can be studied in more detail in the near future.

A number of different strategies are also currently being investigated relating to the effects of gastrointestinal nematode infections and the build-up of anthelmintic resistance. In addition to nutritional influences (relating to maternal protein supplementation and alternative grazing such as Chicory), and the application of dosing management methods such as the TST mentioned earlier, breeding for resistance is currently being investigated as a potential breeding goal for SBF. However, some concern exists that breeding for reduced FEC may have a negative impact on other production traits. As a result, SRUC is undertaking a large, long term, genetic study in which reduced FEC has been added to the current breeding goals for SBF (listed previously). Since 2011, SBF ewes based on SRUC's Castlelaw Farm, have been split into three genetic lines, but managed together, similar to the lines discussed previously consisting of a Selection line, a Control line and a Parasite Resilience line (replacing the Industry line used previously), where animals are selected for breeding according to their overall index value, taking into account the additional FEC breeding goal. The results of this study will quantify the economic and epidemiological benefits of having more resistant sheep to parasites and new research underway will link molecular and immunological indicators of parasite resistance in future genomic selection breeding programmes.

Conclusions

Overall this short summary has highlighted just a few of the studies that have been, or are currently, under way at SRUC in relation to the Scottish hill sheep industry. There are opportunities for hill flocks to help improve their productivity and/or reduce costs in the future whether pursuing one or a number of the approaches highlighted.

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