North York Moors Swaledale Breeders Operational Group

Rural Development Programme for England (2014-2020)

European Innovation Partnership

(EIP- Agri)

Final Report April 2020

(Approved Dec 2020)

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Operational Group name;

North York Moors Swaledale Breeders Operational Group (2017 – 2020)

Total amount of RDPE funding received - £13,134.70

1. Introduction

The project group consists of six North Yorkshire hill farmers who all farm native Swaledale sheep. The group is chaired by farming group member, Mr Tim Dunn. The group was founded as the North York Moors Swaledale Breeders Operational Group to develop this project. The farms are all hill/upland units with between 400 and 1,400 ewes each. Other members of the group include AHDB Beef and Lamb and Kate Phillips, independent sheep consultant. The group have also benefitted from the help and guidance of Signet Breeding Services who are AHDB's breeding evaluation provider for the pedigree sheep and beef industries. The group have used existing technology (ultrasound, EID, etc) to carry out field experiments over three years to develop adapted genetic data collection systems and meat yield assessment technologies suitable for hill farming economics and conditions. Lambs produced through the project have been finished (ready to market) to assess growth to slaughter weight and collection of carcase classification data for fat, conformation, weight, killing out percentage & meat yield from the abattoir. The results of the improved genetics have been verified and used to adapt the farmers individual breeding programmes for the future.

The group requested funding for a three-year project from 2017 to 2019. The project work took place across six separate farms within the North Yorkshire Moors National Park. Four of the original members (including the chairman) completed all three years and two of the farmers changed from years two and three. Each farm developed a nucleus flock of ewes and took part in the project during three lambing periods from 2017 to 2019.

- In 2017, 4 farms were involved in the project. 729 lambs were recorded with either an adjusted eight week weight, ultrasound scan or both. These lambs came from 552 ewes.
- In 2018, 5 farms were involved in the project. 760 lambs were recorded with either an adjusted eight week weight, ultrasound scan or both. These lambs came from 572 ewes.
- In 2019, 6 farms were involved in the project. 883 lambs were recorded with either an adjusted eight week weight, ultrasound scan or both. These lambs came from 656 ewes.

These numbers do not include project ewes that gave birth to dead lambs, or whose progeny were not recorded at eight weeks or scanning. Lambs were recorded with Signet Breeding Services for the purposes of genetic evaluation. Adjusted eight week weight is the weight of the lamb adjusted to 56 days of age. To receive an adjusted eight week weight, lambs must be weighed between 42 and 84 days of age.

Sharing of genetics (Rams) is essential for accurate genetic evaluation. This is explained later in the report.

Two of the farms also finished their lambs to enable the progeny of the nucleus flocks to be assessed at slaughter where additional carcase data within the abattoir (Dunbia) was gathered. In addition, AHDB extended the same finished lamb data collection exercise to a third party farmer (not within the operational group) who purchased lambs in year two and in year three from one of the farmers within the operational group. The results of the additional finished lamb data will appear later in this report. The funding request included spend on the following:

• Ultrasound scanning fees, and genetic data analysis provided by AHDB Signet Breeding Services.

• Laboratory fees for feed/forage samples and DNA testing of the sheep to assess resistance to health issues including Scrapie so that these animals could be positively selected.

• Purchase hire of 2 EID readers and 6 sets of digital weigh cells to equip each farm in the group with the ability to accurately record individual sheep IDs and weights.

• Consultancy services provided by Kate Phillips Consulting to support the project design, trial management, open days and critical data collection.

• Administration & management of the group including group meetings, farm open days and the dissemination of project results.

2. Executive summary

The six North Yorkshire Swaledale farmers have demonstrated that genetic performance recording can be achieved when faced with a sometimes challenging, hill farm environment. Not only have they gathered the relevant genetic data using software and EID technology, they have also learned how to interpret and use that information to inform their breeding decisions. Their aim to use the technology, collect the data, test it on farm and encourage others to do the same, has been achieved.

Highlights from the data include evidence that individual rams performed better across commercial carcase traits and reduced days to slaughter, both of which support a viable & profitable hill farming business and the environment. The farmers have learned that the data not only helps them identify the better performing animals, it also highlights the worst. Large, and arguably quicker gains, can be achieved by removing poorer performing animals from the breeding programme. The groups aim to identify these sheep has been achieved but, performance recording must continue in order for the data to improve in accuracy. It is acknowledged that robust breeding plans must be built over a period of greater than three years.

The native Swaledale sheep breed and its key characteristics have remained of paramount importance throughout this project. All farmers involved are dedicated to improving and protecting the breed for future farming generations. The Swaledale is a native and highly maternal breed – whilst the project has been generating increased data about the breed's performance (rams and progeny), we must note that how that information is interpreted is fundamental. In the future, the group are keen to develop what they have learned and focus on Swaledale females as well as males.

The group have all embraced current technologies and not tested anything which doesn't already exist in the market. However, they have demonstrated to other hill farmers (some of which have been historically reluctant to use it), that it can be implemented within upland farming systems and more importantly, it can provide substantial benefits to its user. The significant benefits are those relating to data collection and how it can be used to make on farm management decisions, eg. targeting the poorest performing tups with the longest days to slaughter or poor daily live weight gains. Examples of this was shown at all on farm open days and widely discussed at industry level. What they have also achieved by default almost, is that the current ultrasound technology (scanning used to assess loin muscularity as a proxy for improved carcase grades) adequately serves its purpose as well as being the most cost effective. A search for new or improved scanning technologies at this stage could prove costly with little or no evidence of any added value.

Hill/upland farmers often discount the latest technologies as they sometimes feel they have been proven in lower 'more favourable' environments and are therefore not relevant to the hill farming sector. The emphasis in the hills has often been placed on hardiness and ability to survive on little, rather than improved performance where the lowland sector have been more suited to place their efforts.

Whilst hardiness and thriftiness are still essential traits of importance to the Swaledale as a breed and hill farming, this project has demonstrated that technologies relating to improved performance (genetic evaluation and data collection) are possible and relevant to the hill farming sector and give evidence to contradict detractors that 'technologies are not relevant to the hills'. This project has promoted and encouraged peer-to-peer learning between some of the 'hardest to reach' farmers and members of the industry.

Early on in the project, the farmers realised that to truly test different Swaledale lamb finishing systems, a project or finishing trial would need to be developed in isolation to gain any credible and robust data. However, the group were able to utilise the different finishing systems they already had in place across the farms within the group. They also recruited a specialist finishing unit (arranged through AHDB Beef & lamb) to track lamb performance. This proved extremely worthwhile as it provided lamb performance data in a different environment as well as highlighting the importance of specific health protocols to improve performance. The results presented some interesting findings around when the lambs perform at their best highlighting that genetics is not the only component for success.

The group has developed an excellent working and partner relationship. Their positive mindset, determination and leadership have helped them achieve their objectives with some excellent results. The same approach will also help them to develop and continue with what plans they have for the future. This will include continuing with genetic data and lamb performance recording as well as incorporating some important breeding information about the Swaledale females. They will also continue to build bridges and make important links with industry, encourage other breeders to take up performance recording, participate in farmer-to-farmer knowledge exchange (which will include planned field trips in 2021/22) and develop further their keen focus on the environment.

3. Operational group aims & objectives

The four aims and objectives of the project as set out in the bid application are:

Aim - To develop new and novel ways of data collection sets that can be used in genetic evaluations for hill sheep carcase traits through the use of EID, weighing/measuring, DNA and CT and ultrasound scanning technologies that specifically suit hill farmers and hill farming systems.

Objective – to develop a blueprint for hill sheep recording developed and disseminated to industry. The uptake in the number of hill farmers using performance recording will be measured as more farmers come to AHDB (Signet Breeding Services) asking for the service.

Aim – To identify Swaledale sheep with better carcase traits (loin, hind leg and shoulder) and use them within a breeding programme to improve carcase quality and consistency

Objective – to improve carcase traits through genetic evaluation of results including scanning results of the loin eye muscle area and fat depth, growth rates and an analysis of carcase classification results. The aim is to lift the number of Swaledale lambs classified as an R conformation or better to 40%, from a group baseline of 30%. Another measure of the success of the project will be the production of high genetic value Swaledale breeding sheep, and the purchase of those by other farmers.

Aim – To assess lambs from the breeding programme through alternative finishing systems.

Objective – to evaluate system costings (cost per kg carcase gain) across lamb groups. Use benchmarking against industry data on lamb finishing systems collected by AHDB Farmbench.

Aim – to develop existing ultrasound scanning technologies designed to measure muscle depth across the loin to provide a measure of total muscle area as an alternative to expensive CT scanning.

Objective - the new ultrasound scanning technology that can estimate meat yield from the drawing of the eye muscle area will be trialled through the project. This new technology should encourage more sheep farmers to use it as part of the performance recording process and its uptake will be monitored.

To be truly innovative, the solutions developed by the operational group must be replicable by other hill farmers. To do so they must be affordable so others are able to adopt them and they must satisfy the needs of the native hill

sheep sector. They must improve the carcase traits of the lambs produced for breeding and slaughter and improve the economic viability of lamb finishing in upland and hill areas.

The project will benefit other sheep breeders through trickle down of improved genetics and uptake of performance recording. In total 850,000 Swaledale ewes (5.5% of the national flock) are farmed across 1,856 farms, with very little recording taking place and these produce breeding sheep for the production of the Mule ewe, This ewe is the cornerstone of the industry with some 1.822m ewes (12.5% of the national flock) across 7,466 farms using the Mule to produce lambs for slaughter after crossing with a terminal sire. This outlines the potential of the project to benefit a vast number of farmers, although we must acknowledge that this will take time. In addition, the supply chain through the processor and retailer will also find benefit through improved carcases and consistency of the product.

4. Project proposal

The project proposal was implemented using the following on-farm measures;

- The farmers tested and developed the data collection processes (using current methods advised by Signet) to ensure they were suitable for hill flocks. An initial selection of potential core nucleus ewes was made in October 2016 to retain on farm in preparation of the project to avoid delaying for another year with final selection of the ewes occurring in 2017 once application was approved for grant. These were representative of the sheep in the commercial flocks and consisted of younger ewes/shearlings to ensure their involvement in the project for the 3 years. This preparation work was not part of the funded project but, it ensured there would be no delays if funding was successful. Additional ewes were added to the project to build numbers in years 2/3, selected using the genetic data collected in the process.
- Ram selection is important - rams were selected to represent what is deemed good Swaledale type (according to the breeders own preference and sound experience), and where possible, to select father/son and sibling rams so that the ability to compare genetic performance could be enhanced. A ram sharing protocol was developed (see in appendix D) so that some rams could sire lambs on 2/3 farms. This was possible due to the range of lambing dates and importantly, it added different environmental factors and how this could affect how the lambs grow on different farms and under different management. All ewes were single sire mated so that lambs could be easily linked back to the sire.
- Ewes are pregnancy scanned in Jan/Feb time annually. This allows an estimate of litter size to be calculated, feeding regimes to be developed and any barren ewes to be excluded.
- At lambing time (March/April) litter size was recorded, lamb birth weight taken and the ewe/lamb management marked. The lambs were then EID ear tagged and reared until a minimum of 6 weeks old when they will be weighed. On lowland flocks this is usually 8 weeks but, due to the need to turn lambs onto moorland to comply with agri-environment scheme agreements the group needed to be able to weigh sooner in some instances. The range is 6 – 12 weeks and at this point the first genetic evaluation can be run to gain an interim report. The ewes and lambs then stay on the moorland, until Sept/Oct when they are gathered (at a time to fit with agri-environment scheme agreements), weighed and ultrasound scanned for muscle depth/area and fat depth at around 21 weeks old. A second genetic report was then produced (Signet Breeding Services).
- Progeny lambs were then taken to slaughter where the carcases were weighed, killing out % calculated and classified for conformation and fat class (assessed using the industry EUROP grid). Extra classification data was collected to score the shoulder, loin and round separately (see results).
- All breeding and genetic data was collected by Signet Breeding Services. The farmers were offered support and guidance to submit the data. Signet Breeding Services also provided ultrasound scanning services.
- All lamb data was gathered by the farmers and collated by Kate Phillips, independent sheep consultant. Kate also offered sheep nutritional and health advice.

- Group management meetings, actions, farm open days and wider industry dissemination was facilitated by Samantha Charlton, AHDB Beef & Lamb.

5. Project results

5.a Project Rams

Six rams were shared by up to three flocks over the course of the three years. Five of these shared rams achieved index accuracies equal to, or over 80%, which shows that sharing these animals, had a positive impact on the accuracy of their genetic evaluations. Connectedness charts produced by EGENES/Signet breeding Services show the strength of evaluation between farms.

Table 1. Connectedness – Project Farms

Farm	Fawbert	Wheldon	Dunn	Graham	Sellars	Barraclough
Fawbert						
Wheldon						
Dunn						
Graham						
Sellars						
Barraclough						

Table 1 shows connectedness between the project farms. Green is deemed 'acceptable' linkage with accurate comparisons between the flocks possible. Red is deemed 'poor' linkage where comparisons between flocks are not encouraged however, comparisons within individual flocks are still reliable.

Three out of the four original group members have achieved green linkage between them meaning animals can be accurately compared on their EBVs and Indexes. Two of the red flocks joined the project late and therefore have not yet built up enough genetic links between themselves and the more established flocks. It is important to state that before this project genetic evaluation was not accurate between any of the above flocks, it is also likely that this chart underestimates the levels of linkage between the flocks. Connectedness is based on back pedigree known to Signet breeding services. As Signet only receives a limited amount of back pedigree in newly recording flocks, the farms probably have more genetic linkage than given credit for due to the nature of pedigree sheep breeding.

Table 2. Project Rams

Year	No. rams with progeny birth notified to Signet	No. rams with progeny birth notified to Signet where rams now have index accuracy ≥50% [most important rams]
2017	40	20
2018	40	28
2019	33	27

Table 2 shows the number of rams used within the project. The most important rams are in the green column, with accuracy values equal to or above 50%. As the project advanced, breeders got better at understanding the importance of rams having good progeny numbers behind them in order to collect more data and improve accuracy of evaluations. In 2017, only 50% of the rams used had enough progeny to carry out accurate genetic evaluation. In 2018, this number increased to 70%. In 2019, this increased to 82%.

82% of the rams used in the final year of the project have ended the project with an index accuracy over or equal to 50% indicating increased progeny group size and more complete datasets as well as use of rams between years. It also demonstrates the learning of group members of the founding principles surrounding genetic evaluation – more data means more accurate evaluation.

It is hoped that following the official end date of the project, members will continue to share breeding stock in order to maintain linkage and will continue to give rams a suitable number of ewes in order to ensure progeny groups remain large enough. The ban of artificial insemination (AI) within the Swaledale society makes the linkage objective much harder than in other breeds where a number of ewes can be artificially inseminated to ensure linkage between flocks. If the Swaledale society were to ever lift their ban on AI, this breeding project could benefit enormously.

5.b Genetic evaluations and data recording

Three years is not long enough to see the full effects of breeding for improved carcase characteristics; data sets need to be collected for longer to increase accuracy and robustness. However, Swaledale lambs were measured using ultrasound scanning across the third lumbar vertebra of the loin as is standard for genetic evaluation. This data feeds into muscle depth EBVs (estimated breeding values) within the genetic evaluation. Single sire mating was implemented across the farms as well as sire sharing. This posed a biosecurity risk so a bespoke protocol was designed in conjunction with the farm vets (see appendix D).

We can successfully identify those rams with better muscle depth EBVs through the project. This muscle depth EBV is rewarded in the index. 2018 data below demonstrates the differences in progeny performance between two rams whose progeny were recorded on the same farm in the same year.

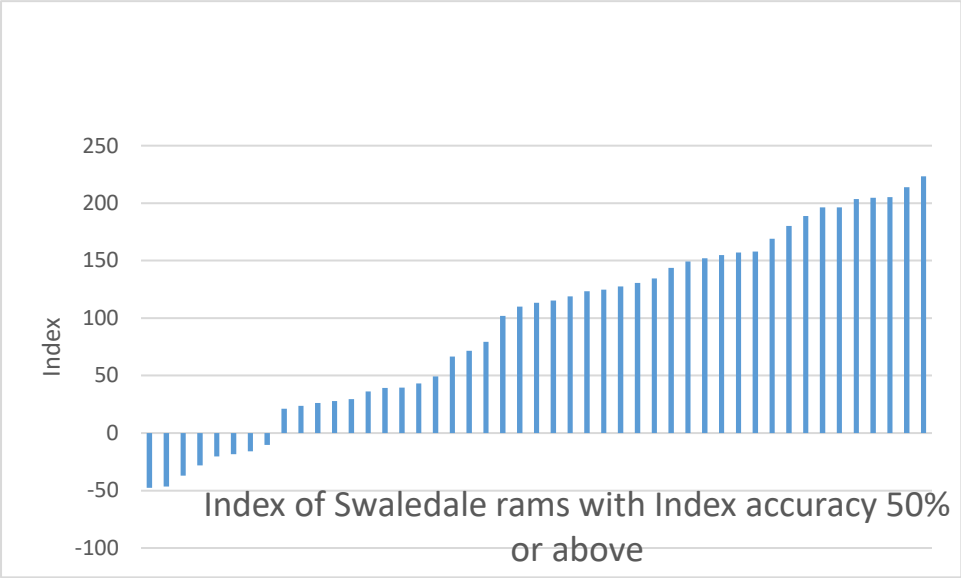
Table 3. Project Rams scanning results

	Index	Index Accuracy	Adjusted progeny eight week weight	Average progeny weight at scanning (131 days old)	Average progeny muscle depth
Ram A	Top 5%	95%	16.4 kg	23.1 kg	14.7 mm
Ram B	Bottom 1%	93%	14.4 kg	20.2 kg	13.2 mm

Table 3 shows that progeny from the ram with the highest genetic merit weighed on average 2kg more at eight weeks and 2.9kg more at ultrasound scanning. This extra growth is of substantial value when you consider that is has be gained from the same inputs. This makes progeny from genetically superior breeding stock more environmentally friendly (they should leave the farm sooner), more profitable (less number of days on farm and improved carcase conformation) and more efficient (better on-farm performance from the same level of inputs). This data also helps demonstrate that improved computed figures (EBVs and indexes) can lead to significant on-farm performance differences.

Each of the blue bars in Figure 1 represents a project ram with recorded progeny. Only rams with an index accuracy of over or equal to 50% have been included to discount rams with low progeny numbers. The average breed index for Swaledale is currently 96. As you can see, we have identified rams that sit either side of this average. Breeders can use this information in two ways; they can select superior rams for breeding (those at the right of the chart) or they can deselect (cull) the poor performers that perform below average (those at the left of the chart). Members of the operational group commented a number of times that to have the information available to make decisions to cull the poor performers is equally as valuable as selecting only those rams with high index figures.

Figure 1. Project Rams recorded progeny



As previously mentioned, three years is simply not long enough to demonstrate the longer term effects of selecting high performing sires on flock performance considering that ewes born in year one of the project only had their first lambs in year three. However, from genetic trends we can see that the lambs average index increased by 14 index points and the average index of sires selected increased by 28 index points comparing year one with year three. This indicates the genetic merit of stock and especially sires selected for breeding are improving. It is still too early to show these genetic trends in graphical form; however, Figure 2 below shows the Swaledale breed 2019 benchmark for reference.

Figure 2. Breed Benchmark 2019 Swaledale

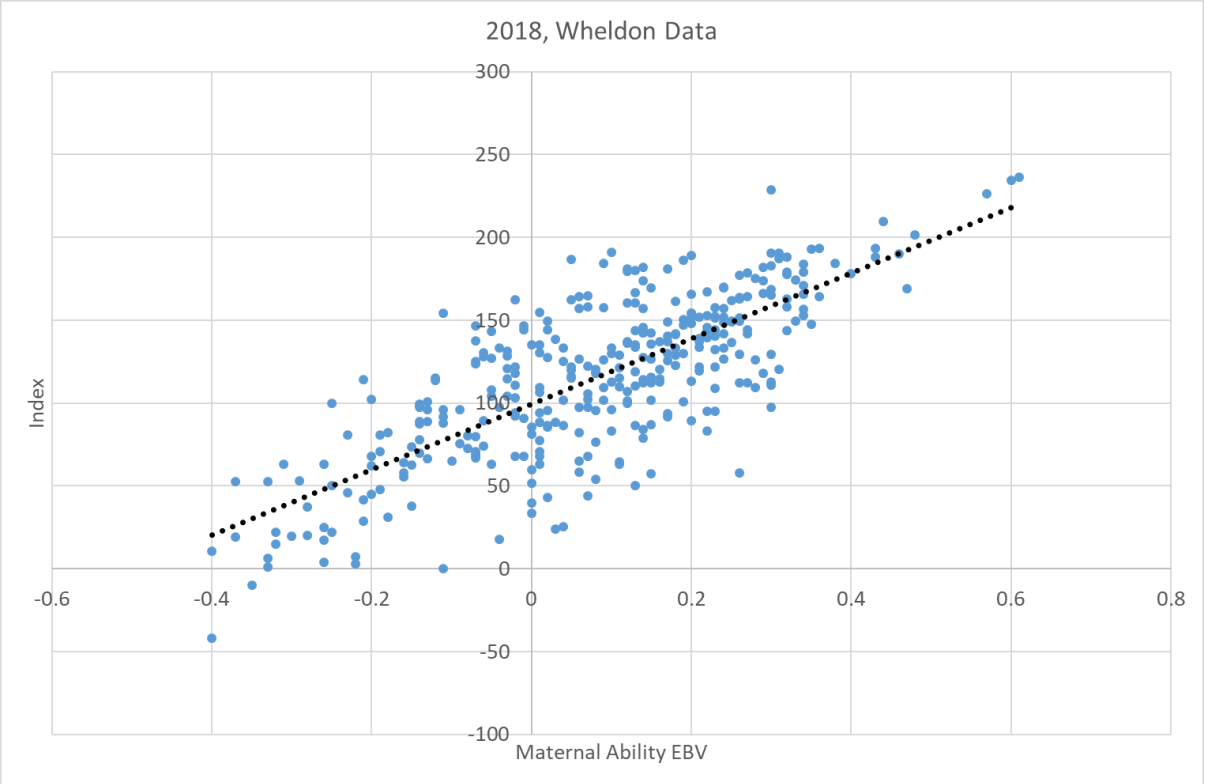
Breed Benchmark for 2019 Swaledale Trait	Bottom 1%	Bottom 5%	Bottom 10%	Bottom 25%	Breed Average	Top 25%	Top 10%	Top 5%	Top 1%
Eight week weight	-1.3	-0.9	-0.69	-0.34	**0.05**	0.44	0.79	1	1.4
Mature size	-1.52	-0.97	-0.68	-0.19	**0.36**	0.91	1.4	1.69	2.24
Litter size	-0.08	-0.06	-0.04	-0.02	**0.01**	0.04	0.06	0.08	0.1
Maternal ability	-0.47	-0.32	-0.23	-0.1	**0.06**	0.22	0.35	0.44	0.59
Scan weight	-1.57	-1.07	-0.81	-0.36	**0.13**	0.62	1.07	1.33	1.83
Muscle depth	-1.11	-0.77	-0.59	-0.29	**0.05**	0.39	0.69	0.87	1.21
Fat depth	-0.27	-0.19	-0.14	-0.07	**0.01**	0.09	0.16	0.21	0.29
Index	-35	3	24	58	96	134	168	188	227

Index values show the range of index seen in 2019, the bottom 1% threshold is -35 and the top 1% threshold 227, so an increase in 28 points shows a notable uplift in the average genetic merit of sires used over the course of the project. This shows that breeders are beginning to understand the importance of selecting superior sires for breeding and the improvement in the accuracy of genetic evaluation.

It is important to highlight that the Swaledale sheep is a maternal native breed and as such, the group were keen to stress that maternal attributes remained vital, even though the aims of the project included enhancing what could be considered as more terminal traits (e.g. growth & carcase). Related to the wether lambs, where some consider them almost a 'by-product' of the hills.

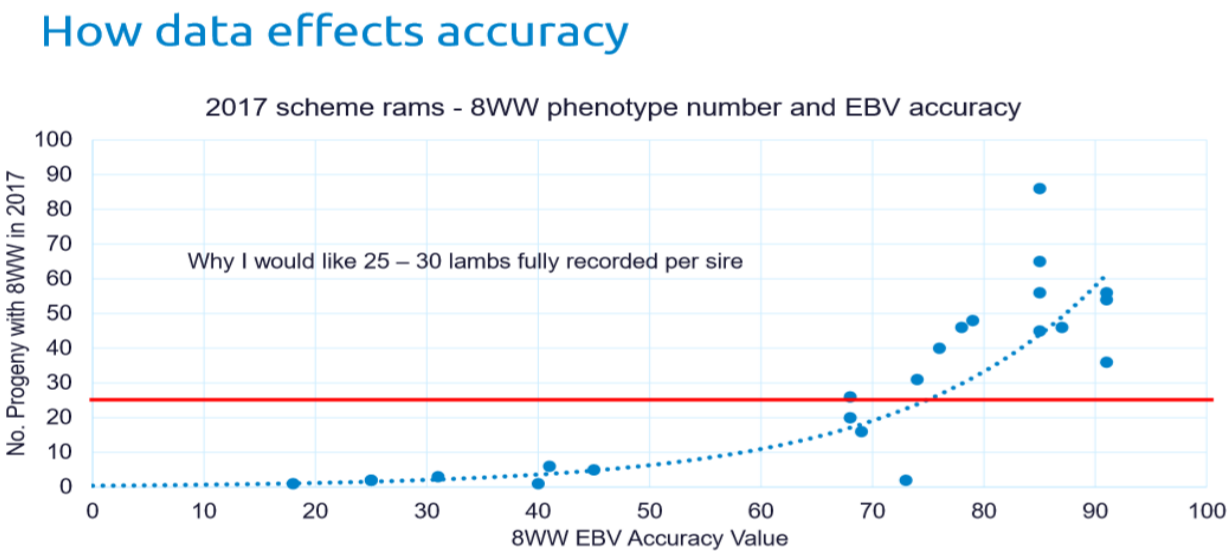
Figure 3 demonstrates that whilst the index increases, so does the maternal ability EBV of the animal demonstrating that maternal attributes remain rewarded within the index. Those sires with a high index should produce progeny who have improved conformation and growth at the same time as producing daughters that go on to be good, milky mothers.

Figure 3. Maternal Ability EBV



Understanding Accuracy Values

The accuracy value represents the amount of data behind an EBV/Index and the heritability of that trait. Carcase and growth traits tend to be more heritable than maternal traits and therefore require less data to make predictions that are more accurate. Accuracy is essentially a measure of risk, the higher the accuracy, the more confidence we have using the EBV/Index prediction and the less risk posed to the breeder making selection decisions.



The previous illustration was shown to the group in August 2018 and demonstrates the effect of data on trait accuracy. As the number of data records increases, so does the trait accuracy. 25 – 30 fully recorded lambs per sire would give accuracy values around 75% and above. Please note this graph is an example used to explain theories to breeders rather than definitive numbers, many factors contribute to accuracy value and since this graph was produced, the data points will have changed – it is for demonstration purposes only.

Hill Index

The key factors contributing to the hill index are:

1. Growth (8week weight & scan weight)
2. Muscle Depth
3. Fat Depth
4. Litter size reared
5. Milk (maternal ability)

Points 1 and 2 are priorities within the project. However, all factors are very relevant and they have been shared widely throughout the project dissemination to illustrate the key areas of focus within the index.

The operational group have led by example in demonstrating performance recording. They have worked with Signet Breeding Services to develop a simple guidance document (see appendix C) and presented at numerous farming groups to explain how it works in practice (also see project dissemination). Members of the group have tracked and shared their progress via social media channels which has served to increase the group and individual profiles across the industry.

5.c Technologies

CT scanning in sheep is the best prediction of carcase composition without killing the animal. However, it can be expensive. Ultrasound scanning is used as the next best approach because it is cost effective, quicker and can be performed on all lambs on-farm. CT scanning takes place away from the farm and usually only includes male lambs that will be sold for breeding or kept for breeding at home.

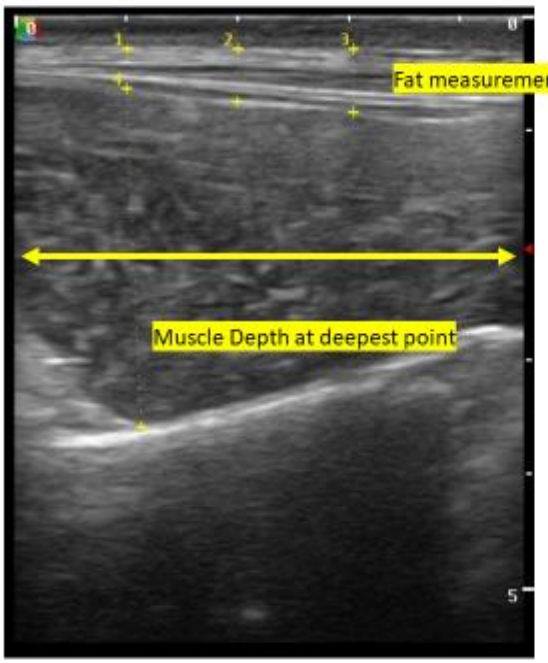
Ultrasound scanning results in a single measurement of eye muscle depth at the deepest point. With CT scanning we can measure eye muscle area by tracing a line all the way around the eye muscle. This is not currently possible with on-farm ultrasound for a number of reasons including the technology available and the biology of the animal.

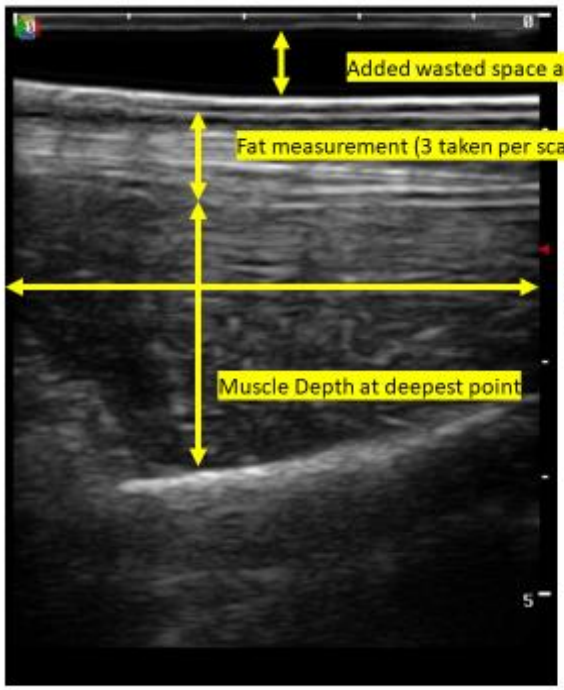
In cattle, a 'stand-off' approach has been used to try to overcome these problems. This technology uses a gel pad that sits between the animal and the ultrasound probe ensuring contact between the two surfaces. This 'stand-off' technology in sheep was tested to see if an accurate assessment of eye muscle area could be done on farm (i.e. a better prediction of total loin muscularity/muscle area). It was quickly apparent that the 'stand-off' approach was not going to be suitable in sheep. This is because 'stand-off' increased the distance at the top of the ultrasound picture but adds nothing to the width, meaning it is still unfeasible to accurately trace the whole eye muscle to assess loin muscularity from the ultrasound image (see figure 4 over page).

Other research has since demonstrated that ultrasound muscle depth and CT muscle depth are strongly correlated: 'This has showed an extremely strong genetic correlation between CT muscle depth and CT muscle area of 0.78 and also Ultrasound muscle depth and CT Muscle Depth of 0.72' (Kaseja unpublished AHDB report, 2018). This means it is logical to conclude that by selecting for ultrasound muscle depth, muscle area is also improved and therefore, it may not be cost effective to change current ultrasound scanning practices. This should encourage breeders that standard on-farm performance recording which includes ultrasound scanning, is suitable to improve the carcase characteristics of lamb without having to use potentially expensive or impractical CT scanning technologies.

Figure 4. 'Stand off' images – sheep.

The two CT images below provide a visual guide to the issues explained earlier with regards to 'stand-off'. The first image with no stand-off and the second showing the effects of stand-off. You can see that the width measurement shows no difference across the two images.





The ultrasound diagram below shows the how the data is collected from the animal based on the measurement points as illustrated. This is the current and most traditional ultrasound method as oppose to the CT images on the previous page.

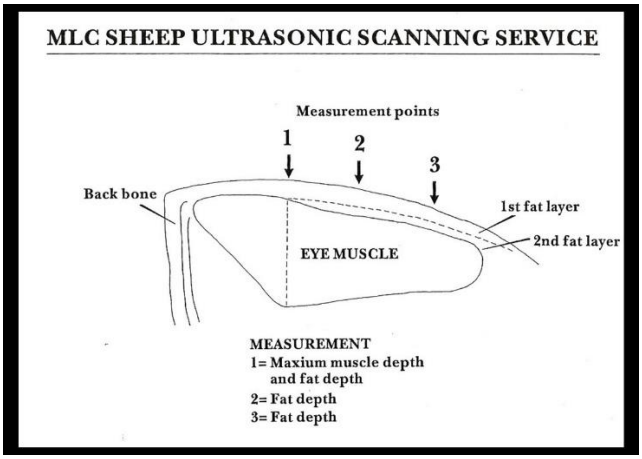


Figure 5. Final project open day – lamb results by sire

AHDB

Mark Graham – Mondays lambs

- Ram: MG
- Low index
- Weight @ scan: 33.9kg
- Loin depth: 17.81mm
- Loin fat: 1.65mm

- Ram: Samson
- High index
- Weight @ scan: 36.4kg
- Loin depth: 19.51mm
- Loin fat: 2.30mm

Rams had similar number of progeny, similar twin rate and sex split and lambs same age @ scanning

What could it be worth? Extra 2.5kg LW & improved carcase muscularity

Figure 5 is a data slide presented at the final project open day in October 2019. Lambs were ultrasound scanned earlier that week and raw results demonstrated as shown. The data taken from ultrasound technology proves that there are significant differences in the carcase composition of live lambs from different sires. The lambs from the high index ram were heavier, had a greater loin depth and greater fat cover indicating that the lambs would be likely to reach finishing weight and fat cover earlier than those of the low index ram.

5.d Lamb finishing

In year two of the project it was decided that participants should simply monitor lamb finishing on their normal finishing system rather than set up lamb finishing trials with different diets as initially intended. This decision was supported mainly because of the additional time requirement; the data collection (performance recording) required

for the genetic evaluations was time consuming and the farmers were not in a position to plant alternative crops or split groups within buildings so a simple monitoring approach was adopted. On two of the farms, the diet included ad-lib silage/haylage and ad-lib compound feed. The results are shown below:

Farm A 2017/18

Carcase data was gathered for 106 lambs**.**

Table 4. Lamb carcase data by sire for farm A

Sire	No. lambs	Carcase wt (kg)	O2	O3L	O3H	R2	R3L	R3H
UK0101700 02894	16	17.7	-	14	-	-	1	1
UK0102024 03571	15	16.8	2	11	1	-	1	-
UK0102060 07217	12	17.3	4	3		3	2	
UK0104654 03126	10	17.8	-	7	3	-	-	-
UK0104827 01481	14	17.1	**3**	**7**	**1**	**-**	**3**	-
UK0106027 03320	16	17.0	2	10	2	1	1	-
UK0106578 03280	13	18.0	2	9	-	-	2	-
UK0106582 01684	7	17.4	-	7	-	-	-	-
UK0122387 00795	3	17.0	-	2	1	-	-	-
Average		**17.3**	**13**	**70**	**8**	**4**	**10**	**1**

Figure 6. Carcase conformation and fat class farm A

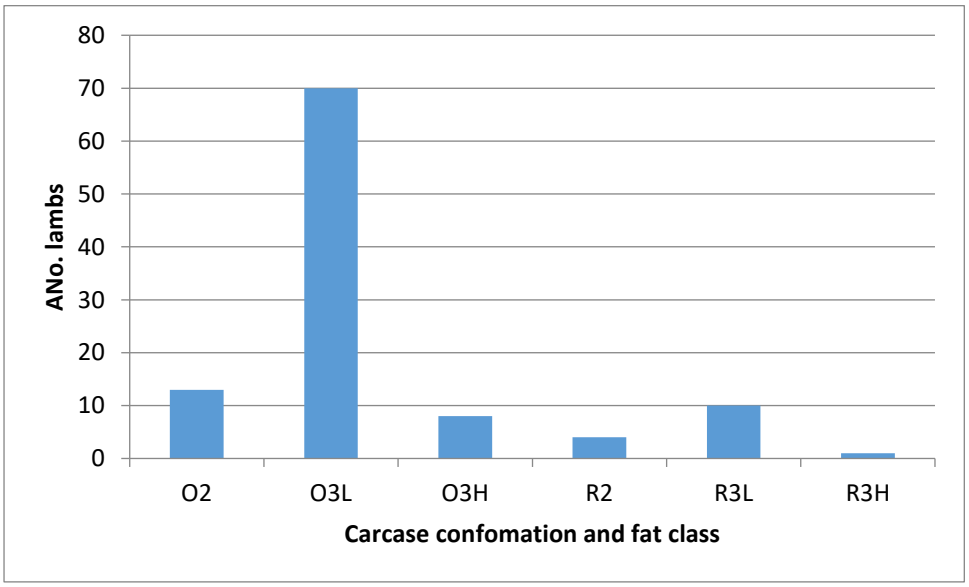


Table 5. Lamb growth and days to slaughter for farm A

	Days to slaughter		DLWG birth to slaughter g/day	
Sire	**No. lambs**	**Days**	**No. lambs**	**DLWG***
UK0101700 02894	17	295	14	**121**
UK0102024 03571	18	302	15	113
UK0102060 07217	15	301	11	116
UK0104654 03126	10	319	9	114
UK0104827 01481	14	**294**	12	**121**
UK0106027 03320	18	295	14	117
UK0106578 03280	14	311	11	117
UK0106582 01684	9	313	8	97
UK0122387 00795	2	305	2	118
Average	**117**	**302**	**95**	**117**

*DLWG calculated by taking an average birth weight of 3.5kg and a KO% (killing out %) of 45, dividing carcase weight by 0.45 and dividing by days from birth to slaughter. The figures in red highlight the sire with the lowest days to slaughter and highest DLWG's.

86% of the 106 lambs finished on farm A graded at O conformation which would be typical for purebred Swaledale lambs. Although lamb numbers by sire were very limited in some cases, the data did show differences between sires for carcase conformation with ram 7217 having 42% of lambs graded at R conformation, as compared to ram 3126 with all lambs at O conformation. Likewise, lambs from different sires grew at variable rates with days to slaughter varying from 294 to 311 days with lambs sired by rams 1481 and 2894 having the highest DLWG and lowest days to slaughter. Extended days to slaughter have a negative impact across various on farm practices and/or outputs. The operational group agreed that reducing days to slaughter would have the largest impact on the environment and cost of production.

Farm B Lamb finishing 2017/18

58 lambs were housed on 18 November and taken through to finish on ad-lib haylage and compound feed. The results are shown below.

Table 6. Lamb performance on farm B

		Range
Birth weight (kg)	3.31	2 - 5
Initial liveweight (18/11/17) kg	33.7	24.6 – 43.4
Liveweight (5/12/17) kg	36.3	26.8 – 46.6
Liveweight (6/1/18) kg	41.1	31.2 – 53.4
Average age at slaughter	264	236 - 331
DLWG 18/11/17 to 6/1/18 (g/day)	151	0 - 280
DLWG (birth to 6/1/18) (g/day)	155	111 - 201
DLWG (birth to slaughter) 58 lambs (g/day)	149	106 – 188
Average carcase weight (58 lambs) (kg)	18.4	12.5 – 24.5

It was agreed that, lambs on farm B showed very acceptable rates of gain through the winter but finishing was very expensive. This farm managed to keep accurate records of feed usage. 64 lambs ate 4.4 tonnes of concentrates between 11/11/17 and 28/3/18. This was an average consumption of 69 kg/head. This cost approximately £14/head plus cost of haylage. The last 12 remaining lambs proved to be very inefficient and consumed an extra 86 kg of feed per head over 72 days.

Performance of the lambs was recorded individually and by sire. Again, there were very few lambs by some sires so no conclusions can be drawn from that data but lambs generally performed well averaging over 140g/day and reaching good carcase weights for the breed as shown in table 7.

Table 7. Lamb performance on farm B

Sire	No. lambs	DLWG g/day	Days to slaughter	Carcase weight (kg)
UK0100586 00872	18	145	269	18.4
UK0102024 03571	3	146	278	19.0
UK0103070 03065	1	158	258	19.5
UK0103095 02592	3	166	251	19.8
UK0104654 03126	7	149	259	17.5
UK0114019 07569	2	157	279	19.5
UK0122062 06813	1	143	250	16.5
UK0122387 00795	13	148	251	17.7
UK0131850 00963	1	135	323	19.5
UK0132526 03839	6	159	262	19.4

Figure 7. Fat class and conformation scores farm B

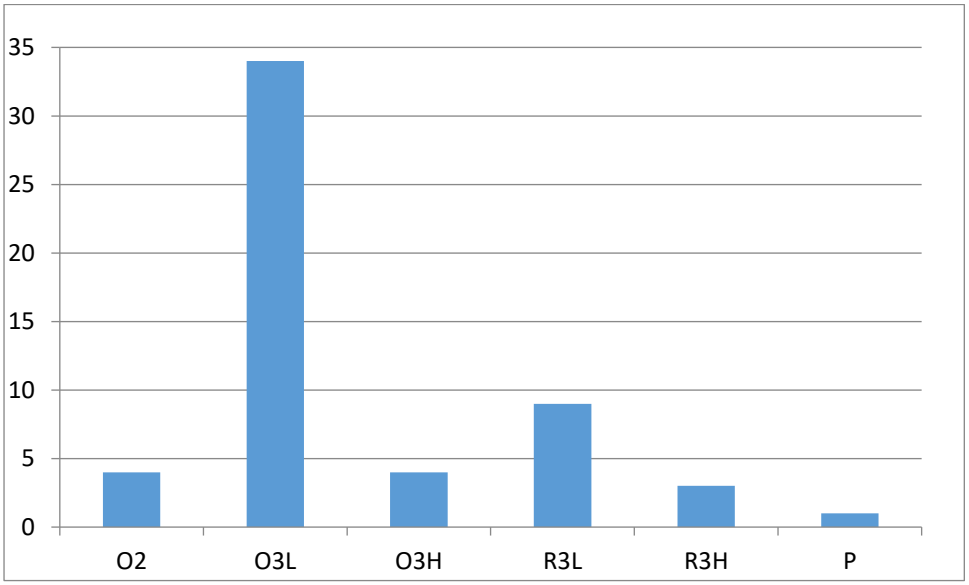
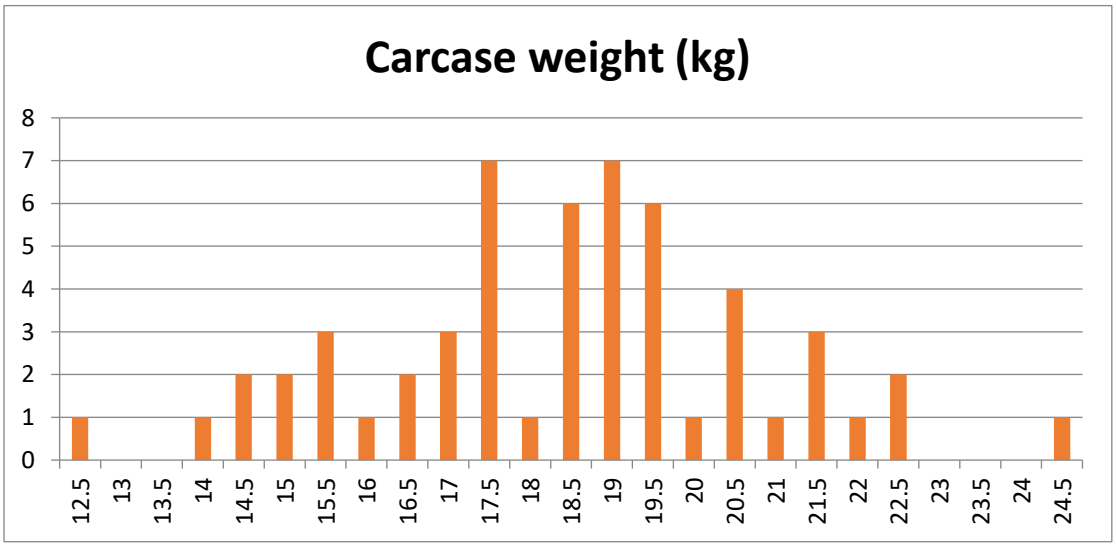


Figure 7 shows the fat class and conformation scores for the whole group showing a very high proportion of O grade lambs (76%) compared to R (22%).

Figure 8 shows the very wide range of carcase weights from 12.5 to 24.5 kg.

Figure 8. Carcase weights for farm B



Lamb finishing 2018/19

In the winter of 2018/19 lamb growth over the winter finishing period was monitored for farm A and B using a very similar system to that used in 2017/18. One other farm (farm C) also chose to finish lambs at home on either haylage and concentrates or stubble turnips followed by haylage and concentrates.

One of the other farmers within the operational group (Farm D) decided to sell 500 lambs to a specialist lamb finisher and for that farmer to monitor performance of the lambs. A separate agreement was made with this farmer and AHDB Beef & Lamb which was outside of the main project funding. Lambs were moved from the home farm to the finisher in early October 2018 then growth and carcase data was gathered for all lambs. A bespoke health plan

was put in place to reduce lamb mortality which had been a problem in previous years with Swaledale lambs (see appendix E).

Lambs sent away by farm D for finishing were treated as follows:

- 4 October - lambs arrived at finisher farm and turned out to grass to get used to the electric fence.
- 8 October - weighed, given fluke drench and multivitamin, split into two lots into a field only with electric fence and provided with ample grass.
- 11 October- '3in1' feeders introduced on restricted setting and filled with a mix of 2% molasses, 15% soya, 41% Max treated Barley, 42% Max treated Oats, Evo (feed additive).
- 18 November – recorded that 8 lambs had died.
- 19 November - the small group of lambs was weighed then introduced to fodder beet in-situ and remained on the restricted access barley based mix and grass.
- The bigger group of lambs had been moved a few days previously.
- Towards the end of November all lambs went onto a mix of 2% molasses, 15% Soya, 10% Oats, 73% Barley, 'Evo'. .
- Last 60 lambs left on farm had a an all in one fluke and worm drench around early April.
- They were not given any more treatments at all except the antibiotics 'Alamycin' or 'Betamox' for individual foot problems.

At the end of the finishing period, the finisher farm had collected 463 sets of complete lamb data from delivery to slaughter, 20 lambs had died (4% losses) and there were 19 no reads tags at the abattoir.

Of the 20 lambs that died 8 post mortems were carried out by the practice vet. The causes of death were as follows:

- 2 chronic pneumonia
- 1 liver abscess
- 1 acidosis
- 1 pyelonephritis and endocarditis – likely secondary bacterial infection from kidney or foot lesion
- 3 unknown cause

Cost of finishing

Table 8. Cost of lamb finishing on specialist finisher farm (482 lambs finished).

	Total	£/lamb finished
37 tonnes of home mix	£8,800	£18.26
45 haylage bales @ £30/bale	£1,350	£2.80
3 acres of fodder beet @£400/acre	£1,200	£2.49
Veterinary costs		£1.09
Marketing and haulage		£4.38
Sundries		£2.24
Fixed costs		£12.69
Total	£11,350	£43.95

- **77** kg of home mix per head
- Total feed costs = £11,350 or £23.55/lamb
- To gain 12.5 kg = £1.88/kg LW for feed alone
- Total cost per kg of gain £3.52.

Growth rate

Growth rate was assessed approximately monthly until lambs were sent for slaughter. Lambs averaged 33.8 kg on arrival but ranged from 23.2 to 47.5 kg. On average lambs remained on farm for 169 days but this varied from as little as 109 days to 216 days showing huge variation in performance. Between October and early January average daily live weight gain was only 34 g/day but from January onwards DLWG increased markedly to average 125 g/day.

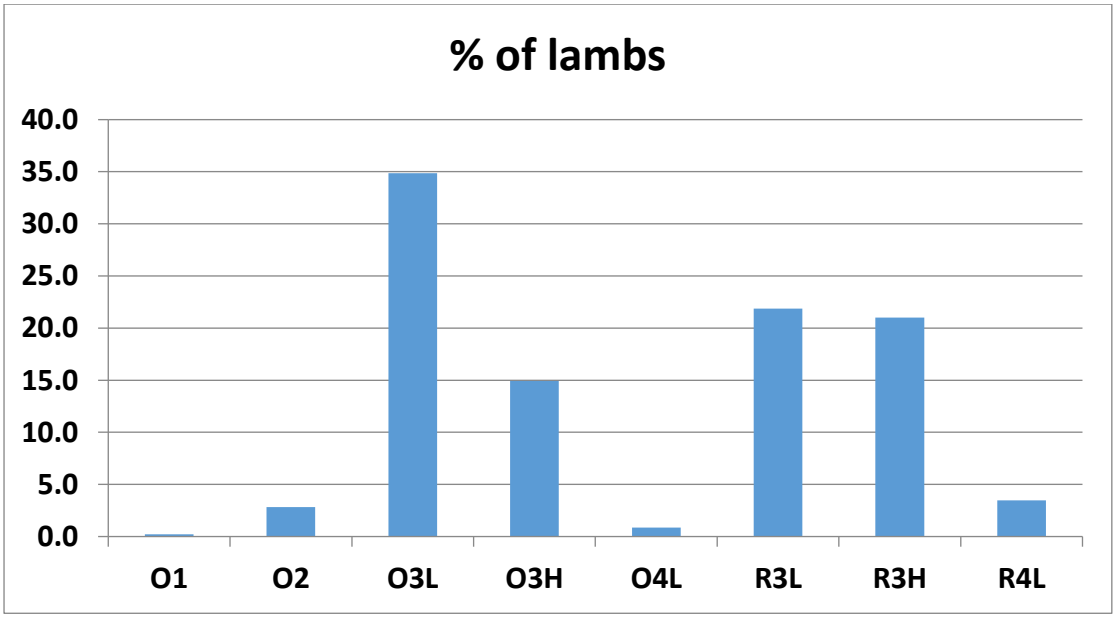
Table 9. Growth rate by weight band over first 100 days

Weight (28/9/18) (kg)	Number of lambs	Average weight (kg)	Average DLWG over first 100 days (g/day)
23.2 to 30	114	27.9	68
30.1 to 35	232	32.5	30
35.1 to 40	127	36.9	16
40.1 +	22	42.4	**- 17**

It was interesting to note that the smaller lambs seemed to be growing much faster than the larger lambs - suggesting that they perhaps had been born as twins and therefore needed to depend on grass from an earlier age than their single born counterparts. This low growth rate in early winter may also have been related to declining day length. Please note that these are assumptions only and further research would need to be carried out before any firm conclusions could be drawn.

Figure 9 shows the percentage of lambs by each carcase grade.

Figure 9. Percentage of lambs by carcase grade



53.6% of the lambs sold graded as O conformation and 46.4% graded as R. This was a high proportion of R grades but lambs were taken to heavy weights and in many cases were sold overfat for normal abattoir specifications. Unfortunately, only 40 of the lambs finished were from known sires so performance by sire cannot be reported with any accuracy. Table 10 shows the data collected.

Table 10. Lamb performance and carcase grading by sire.

Ram name (no.lambs)	**Wt leaving farm D (kg)**	**Days to sl**	**Carcase wt (kg)**	**O2**	**O3L**	**O3H**	**R3L**	**R3H**	**R4L**
				Number of lambs					
Barry (8)	32.4	172	21.6		4		2	2	
MG (6)	33.1	151	22.0		2		3	1	
Samson (5)	34.9	167	22.6		4			1	
Thornbrough (6)	31.1	161	22.3		2			4	
UK 0 122387 00795 (6)	32.8	170	21.6	1	2			3	
Wear (9)	30.7	154	22.3		1	4	1	2	1
All				1	15	4	6	13	1

Farm A lamb finishing 2018/19

Farmer A was unable to monitor growth rates through the winter due to a fault with his weigh crate and therefore it is only possible to report on carcase data.

Table 11. Lamb carcase weight, days to slaughter and carcase gain/day Farm A

	No. lambs	Carcase weight (kg)	Days to slaughter	Carcase gain/day (g/day)
All lambs	143	16.60	309	53
Ram				
Marks	12	16.70	288	58
2894	33	16.65	306	54
3571	33	16.50	298	54
3126	11	16.58	315	53
3320	12	16.04	323	50
3280	15	17.09	321	53
7372	15	16.73	307	54

Again, there were limited numbers of lambs finished for some sires but the table shows the highest carcase weight for lambs from ram 3280, shortest days to slaughter and highest carcase gain per day for lambs from ram 'Mark'.

Table 12 shows the percentage of carcases by conformation and fat class.

Table 12. Percentage of carcases by conformation and fat class.

% of carcases	O2	O3L	O3H	R3L	R3H
All lambs	4.9	60.1	3.5	28.7	2.8
Ram					
Mark	0.0	66.7	0.0	33.3	0.0
2894	3.0	66.7	6.1	27.3	3.0
3571	9.1	45.5	3.0	39.4	3.0
3126	0.0	63.6	0.0	36.4	0.0
3320	8.3	58.3	0.0	33.3	0.0
3280	0.0	46.7	6.7	40.0	6.7
7372	6.7	86.7	0.0	0.0	6.7

In general, the processors prefer carcasses graded at R (average) rather than O (below target) as the lean meat yield is superior. Lambs sired by 3280 and 3571 (total of 46.7 and 42.4% R grade respectively) appeared superior to other rams in this respect with sire 2894 showing the lowest percentage of R grade lambs.

In summary for farm A:

- Ram 3280 – heaviest carcases and highest proportion of R3L carcases, but long finishing time – 321 days
- Mark's ram – shortest days to slaughter – and fastest rate of carcase gain
- Ram 3571 – high proportion of R3L and second shortest days to slaughter
- Ram 3320 – lightest carcase weight and longest days to slaughter – very slow growing

Farm B lamb finishing 2018/19

A total of 80 lambs were finished on the home farm as in 2017/18 on haylage and ad-lib compound feed.

Table 13 shows the performance of the lambs by sire.

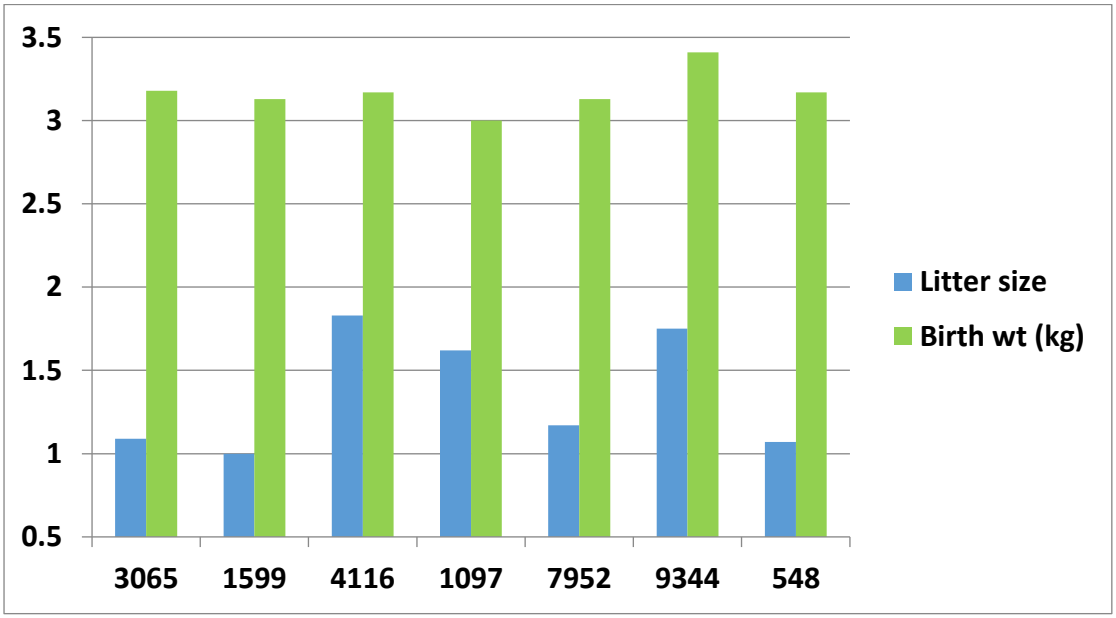
Table 13. Lamb performance by sire Farm B

Sire	No. lambs at start	No. lambs to slaughter	Litter size (average lambs per ewe)	Birth weight (kg)	Weight on 6/12 (kg)	DLWG birth to 6/12 (g/day)
3065	11	10	1.09	3.2	29.2	147
1599	4	4	1	3.1	25.9	85
4116	24	23	1.83	3.12	30.2	85
1097	13	12	1.62	3.0	31.3	132
7952	12	10	1.17	3.1	25.7	85
9344	12	9	1.75	3.4	35.5	148
0548	14	12	1.07	3.2	27.6	96
Total	90	80	1.45	3.2	30	121

The number of lambs by sire kept for finishing was variable and for sires with less than 10 progeny the results should be treated with caution. It was notable however, that progeny from sire 9344 were born mostly as twins and had the highest DLWG to early December. Likewise, lambs born from sire 3065 were mostly born as singles but, also had high DLWG to December.

Figure 10 shows the estimated birth weight and litter size by sire.

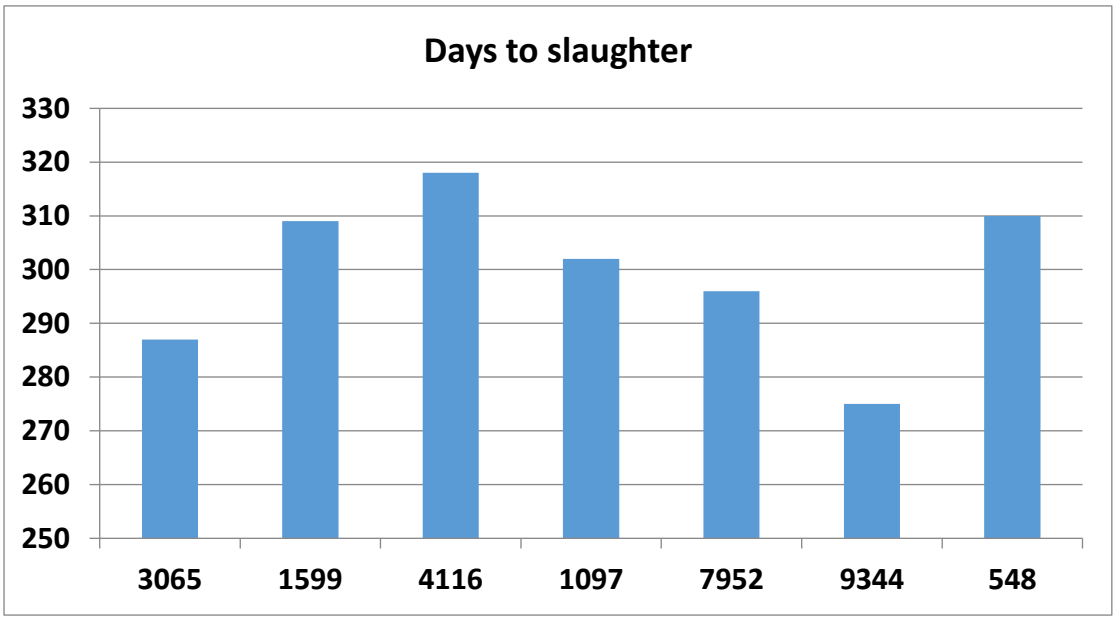
Figure 10. Lamb litter size and estimated birth weight by sire Farm B.



Rams 4116 and 9344 had high litter sizes and high average lamb birthweight.

Figure 11 shows the average days to slaughter for lambs by sire.

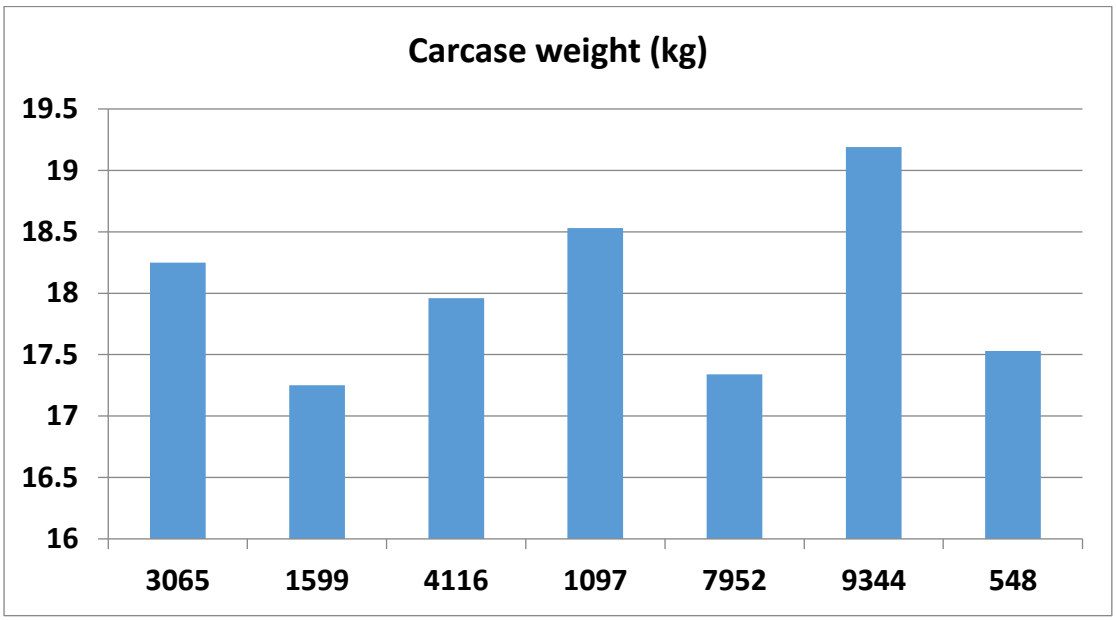
Figure 11. Average days to slaughter by sire



The high growth rates of lambs from 9344 and 3065 resulted in fewer days to slaughter helping to reduce costs of finishing.

Figure 12 shows the average carcase weights of lambs by sire Farm B.

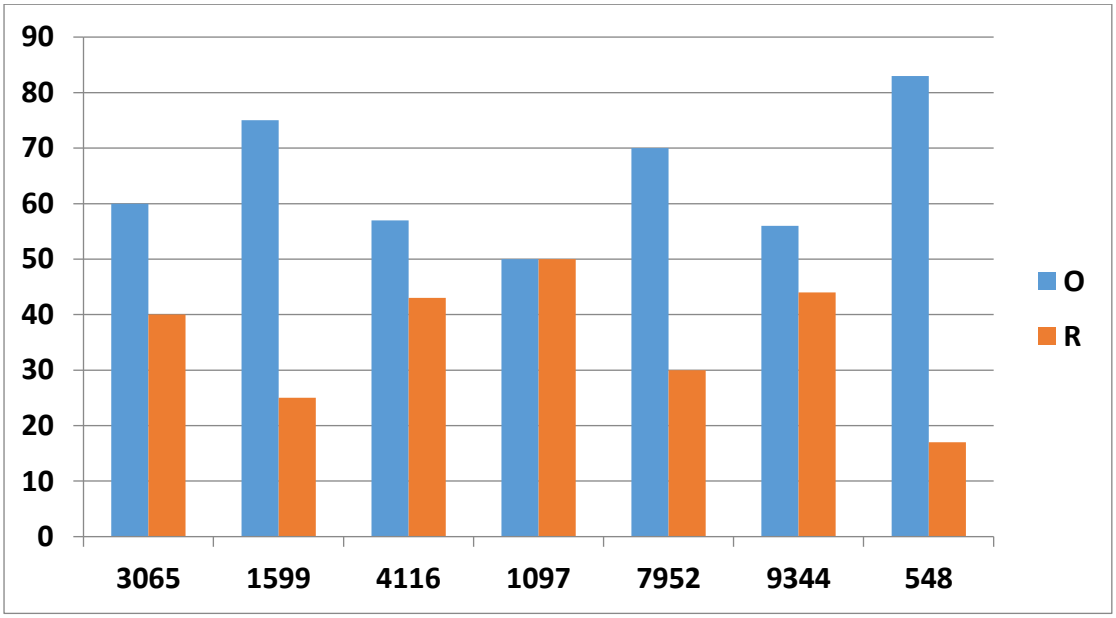
Figure 12. Average carcase weight by sire Farm B.



Again, the lambs born to sire 9344 stood out with high growth rates and shorter days on farm resulting in the heaviest carcases.

Figure 13 shows the average carcase conformation of lambs by sire. Although the majority of lambs graded as O on the EUROP grid some rams had a higher proportion of R grade lambs than others, notably lambs sired by 1097.

Figure 13. Carcase conformation by sire Farm B



Given that there were limited numbers of lambs finished per sire the results should be interpreted with caution, but it would appear that lambs sired by ram 9344 performed exceptionally well. They were:

- Heavier at birth – despite high litter size
- Grew faster

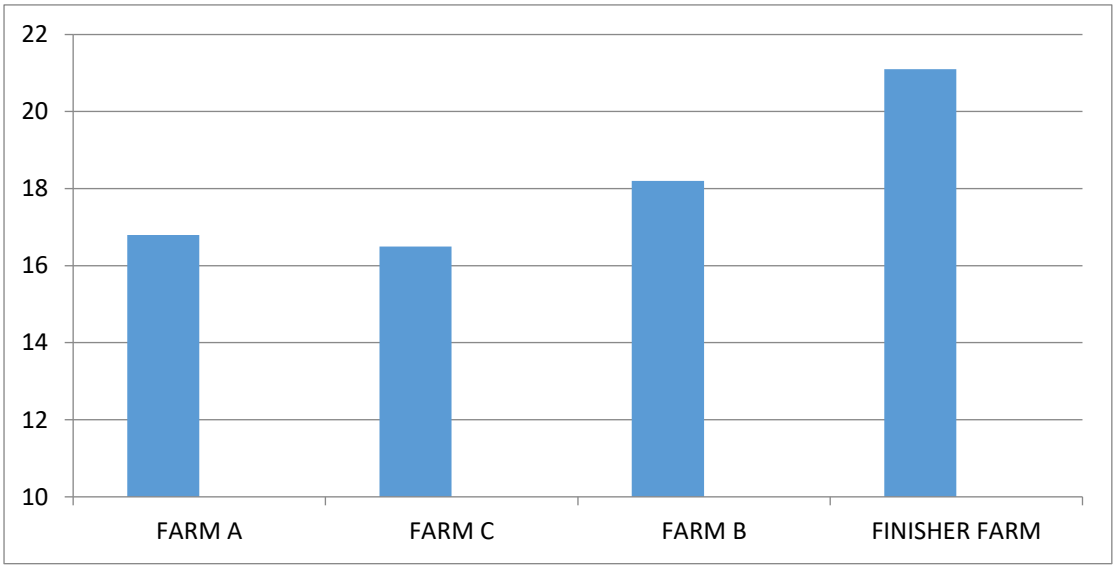
- Finished quicker
- Had the heaviest carcases
- Had a good proportion of R conformation lambs

5.e Lamb carcase data

In early April 2019, 226 lambs were taken to the Dunbia Preston abattoir for slaughter. These lambs came from four of the operational group farmers; farm A, B, C and the finisher farm (lambs purchased from Farm D). The highest proportion of lambs came from the finisher farm.

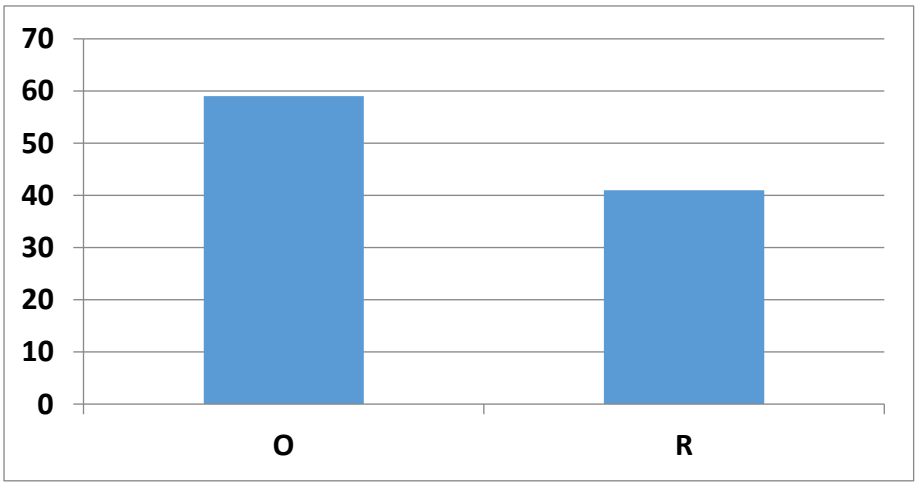
24 lamb carcasses were selected for primal joint assessments and 3 lambs were chosen from each of 8 sires from three of the producers (farms A, B and C). Unfortunately, lambs from the finisher farm did not include enough lambs of known parentage so could not be included in carcase assessments apart from routine carcase grading for fat class and conformation.

Figure 14. Average carcase weight by producer.



It was notable that the finisher farmer took lambs to much heavier weights than the other farmers did and many lambs graded at 3H or higher.

Figure 15. Carcase conformation of all 226 lambs (%)



The high proportion of R conformation lambs in this consignment reflected the high number of lambs sent for slaughter that day by the specialist finishing farm and the high level of fat on some of those carcasses.

Figure 16. Lamb carcase conformation by producer (% of lambs)

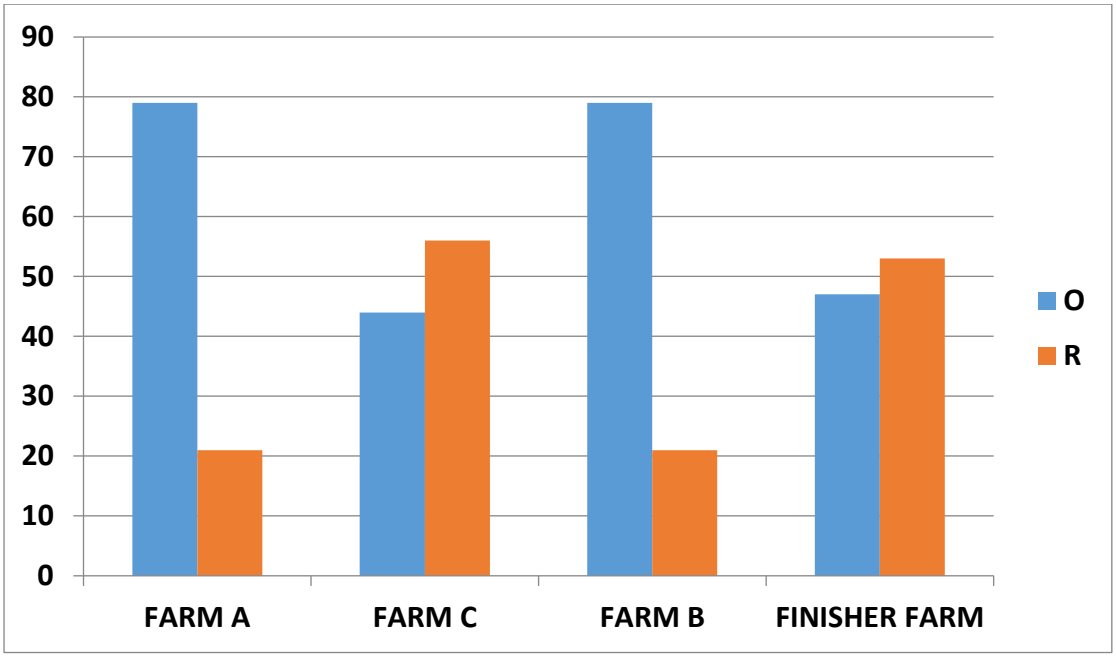
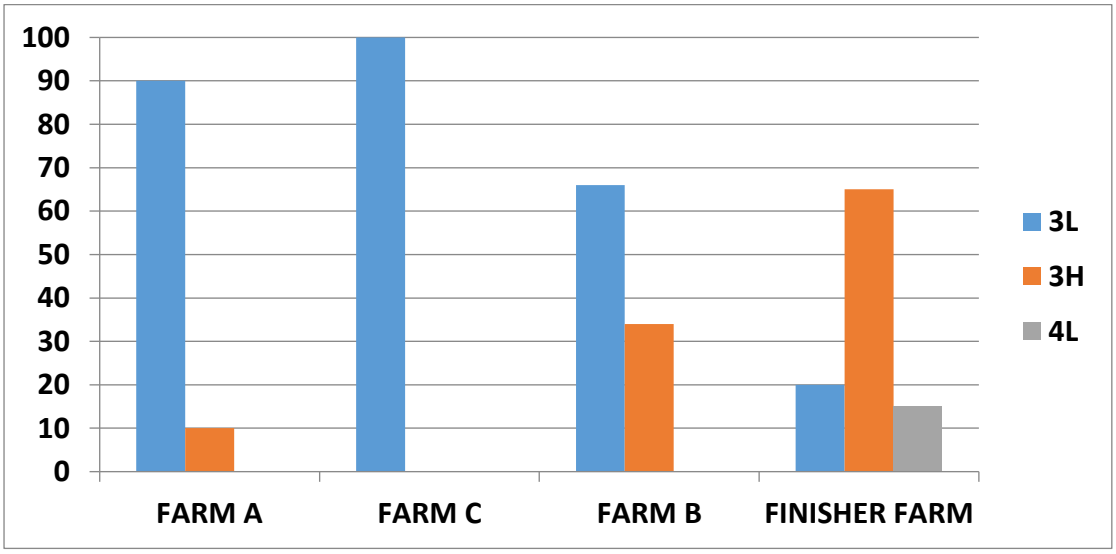
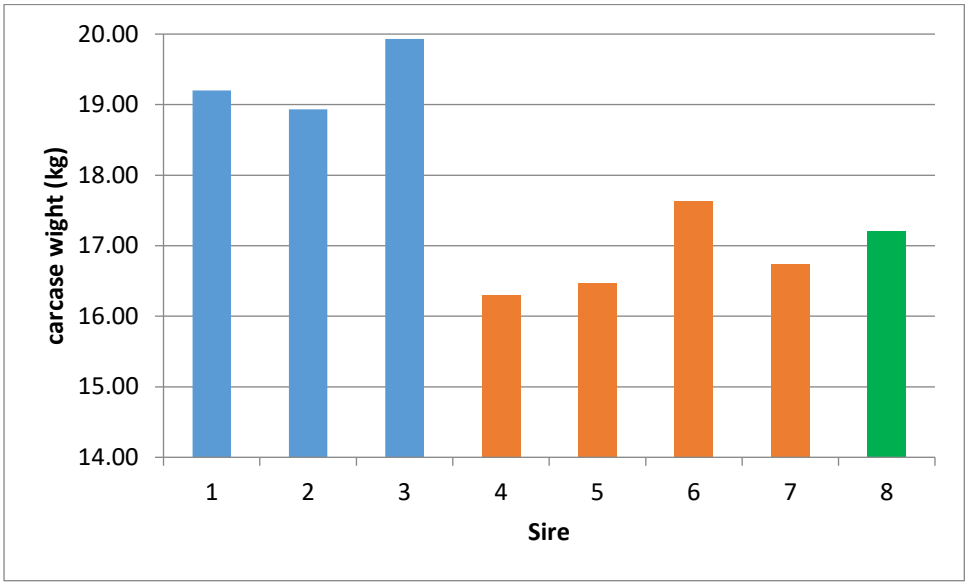


Figure 17. Lamb carcase fat class by producer (% of lambs).



It was notable that all lambs from Farm C graded at the R3L.

Figure 18. Cold carcase weight by sire (kg)



For the lambs that had known sires, the average carcase weight was calculated and this is shown in figure 12. Large differences between sires were noted but the data needs to be interpreted with caution due to low numbers of lambs for each sire. It was notable that lambs from farm B (blue in the figure) were heavier than lambs from the other producers.

Carcasses were cut into primal joints and weighed, loin length was measured and fat trim removed and weighed. Key results are shown in the figures below.

Figure 19. Weight of whole legs by sire

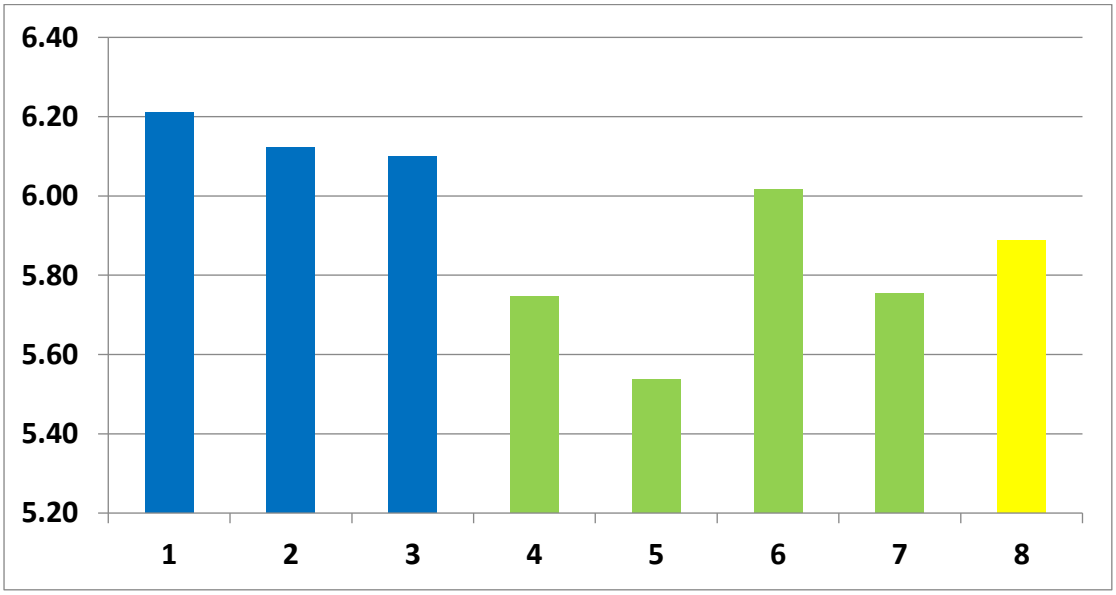
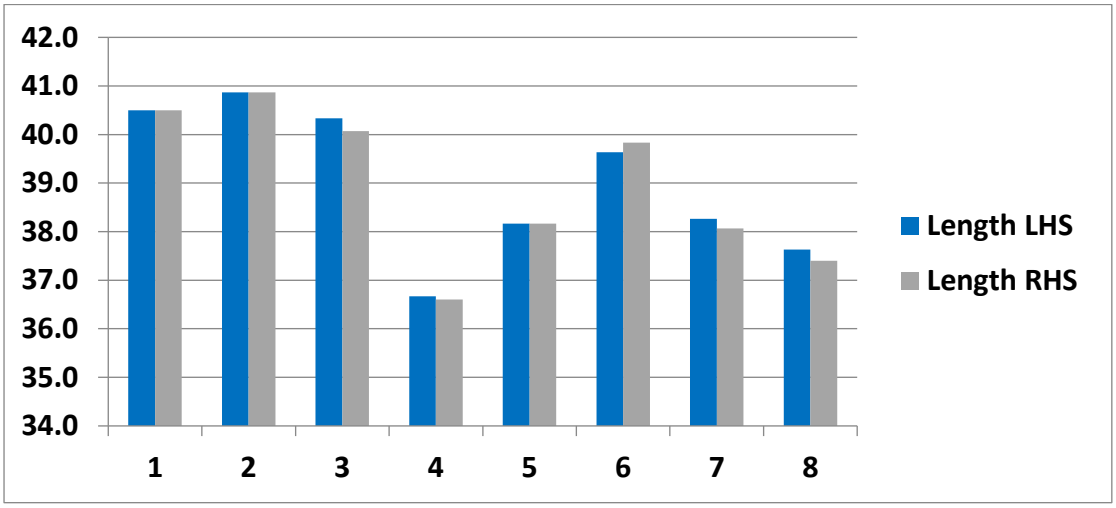
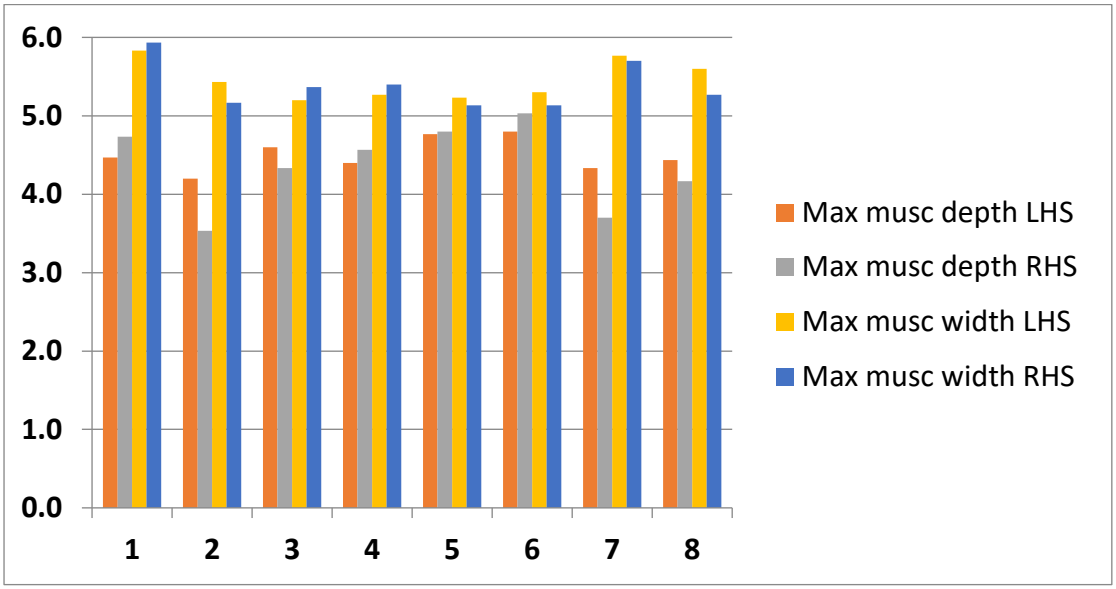


Figure 20. Loin length – left hand (LHS) and right hand sides (RHS)



The 9 lambs from farm B had the longest loins (sires 1, 2 and 3). Ram 9344 (number 1 as shown figure 18 - 21) consistently performed well in almost all assessments.

Figure 21. Loin muscle depth and width



Muscle depth and width was variable across all sires but sires 1, 7 and 8 showed the highest muscle width.

The lamb carcase data shows variable and inconsistent results across all four farms. Having greater volume of data may have helped to rectify this but there are no guarantees. What the results do show is the various management strategies on farm does have a varying effect on output (defined in this instance by lamb carcase classification). For example, the finishing farm results showed greater carcase weight and fat. For each business, their carcase objectives may well differ and therefore, the 'perfect specification' may not exist and could well differ according to each processor/retailer requirements. What is clear is that in order to draw any firm conclusions from this carcase information, a more detailed and prescriptive finishing project would need to be carried out. Each of the farms would need to be working to the same objectives and within the same parameters in order to make direct and accurate correlations. Any future ambition or scope for this type of work in the future (working specifically with upland breeds) would have to be investigated outside of this project.

The sire analysis against the carcase data is more clear with at least three sires showing more positive results than others and one sire in particular, no 9344 (number 1 in all figures) performing well across all assessments. This confirms that performance recording can generate data significant enough to allow the farmers to use the information to help inform decisions within their business. Quality data of sufficient amount for genetic purposes (<25 lambs per sire & minimum 15ewes) will increase accuracy and therefore decrease the risk to those who wish to use the data to add value to their business. For the farmers within the group, this was as much about removing the underperforming animals as much as selecting for those higher performers.

How the data will be used is critical when considering how much data to collect in the future and which data the farmers within the group will continue to evaluate. Volumes of data providing little or no value is equal to providing no data at all and therefore it must demonstrate purpose and value to the business through clear interpretation. Through the support of experts and the projects objectives, the farmers within the group clearly understand and embrace this approach to the extent that the will continue to collect, record and interpret the relevant data in the future as well as promote these methods to others.

6. Building bridges Between agricultural industry & research

The operational group have led by example in demonstrating performance recording. They have worked with Signet Breeding Services to develop a simple guidance document (see appendix C) and presented at numerous farming groups to explain how it works in practice (also see project dissemination). Members of the group have shared their progress and lessons learnt through our regular farm open days, industry meetings and via social media channels. This activity has increased the group and individual profiles across the industry creating a forum for discussion and peer-to-peer learning.

Signet Breeding Services has worked with the project farmers as much as possible to ensure data deadlines suit both the farmers and hill farming systems. This includes the tailored Hill Index, which helps to simplify EBVs generated from performance recording (see results). The Hill Index includes growth traits (eight week weight and scan weight), muscle depth, fat depth, litter size reared and maternal ability. The emphasis has been placed on growth and carcase traits, however if required in the future, these breeding priorities can be changed. The development of this index provides an open door to industry and others who would like to learn or participate. Whilst these types of datasets are not new or novel within the sheep industry, in the hill sector performance recording and genetic evaluation are much less utilised than in lowland breeds. Reasons for this include; time, cost and less frequent access to the sheep than is typical in lowland flocks. This North York Moors operational group has clearly demonstrated that robust genetic evaluation is possible in a hill environment and acts as leader group for other interested breeders using similar systems. Throughout the project, the group members have encouraged and developed relationships with their peers answering questions about the project and its benefits.

Since the beginning of the project in 2017, upland recording flocks have increased from 41 to 48 (Signet Breeding Services). One of those flocks belongs to a college who have engaged with this project from the outset. This will enable our next generation farmers to learn the benefits and early adoption of performance recording in the uplands

From the outset, group members have been determined that key industry stakeholders and breed societies would be welcomed throughout all parts of their journey. By communicating effectively with these parties throughout the project, the group are confident that this has been achieved through positive feedback and support, participation in open days and reciprocal invites to speak at external group meetings (see dissemination). Foundations have been successfully built to continue working together in the future.

In 2019, group chairman was asked to present at a leading industry conference, Sheep Breeders Roundtable and more recently, at the NSA breed society forum in Edinburgh. His presentation was well received and provoked increased discussion across the industry, the results of which will be seen outside of this project timeframe.

The group have also been invited to facilitate a joint meeting between themselves and a breeding project in Wales run by HCC. The Hill Ram Scheme will use DNA parentage to assign parentage to performance recorded lambs and collect on farm performance data in much the same way at the NYM group have over the last three years. Both groups are optimistic about future opportunities to collaborate.

Project legacy and continued commitment by current group members will be key in building upon industry links that have already been developed. There is no doubt that the last three years have provided the group with a spring board approach but, implementation and substantial behavioural change within the industry will require continued dedication and commitment by all parties.

7. External project benefits

Environment and the landscape

Sheep are the main grazing animal in upland areas and are important to deliver a range of 'ecosytem services'. Our uplands are endowed with natural assets that are important for delivering a range of these valuable ecosystem services, including food and fibre, water regulation, carbon storage, biodiversity, renewable energy and recreational opportunities for health and wellbeing. Seventeen of the UK Biodiversity Action Plan priority habitat types are found in the English uplands (including blanket bog, limestone pavement, upland calcareous grassland, upland heathland and upland oakwood). They support internationally important species including breeding birds as well as playing a role in conserving the genetic diversity of farmed animals (cattle, sheep, and equine breeds). These important surroundings are fundamental to the farmers within this group, their peers and wider community.

Farms within the operational group have not increased livestock numbers and instead their focus is to optimise efficient production from current farm output. By doing so, they have been able to develop a genetic performance recording system in conjunction with current (and future) agri-environment schemes that farmers deliver in the uplands. In addition, with an improvement in carcase traits, the cost both financially and environmentally (e.g GHG's) to produce a kg of lamb, will reduce. Historically, there has been research carried out to prove the link between the most efficient farms and those with a lower carbon footprint (EBLEX report). With an ever-increasing focus on this very topic and through the work carried out during this project, the group farmers are firmly heading in the right direction to be able to evidence this very point. With the removal of BPS payments confirmed, they support a future where viable upland farming businesses can deliver efficient food production and thrive within their natural environment and landscapes.

Social benefits - community and relationships

The operational group have hosted open farm days annually since year one. This provided the opportunity for fellow farmers and industry to learn more about the project, observe live demonstrations (scanning and butchery) and interact with each other about shared interests (see summary of event feedback Appendix G). Simultaneously, the group members had the opportunity to gauge interest, ask for feedback and receive some well-deserved support. As a result, we have now developed a well-established community group that have followed and encouraged the project along the way whilst also providing a solid 'sounding board'. Attendance across the three year open farm days increased from 24 to 43 average as too did the number of comments/feedback received. This has provided excellent links with industry and peers from other upland areas including the wider North East Region (including Northumberland), the North West and Wales.

The group itself represents a good spread of farming generations (age demographic). This has encouraged younger generations to become actively involved or follow their progress. Engagement with our next generation farmers is critical to the level of uptake and long-term industry gain.

The group members have experienced a series of change since project inception. Farming members have left and new ones recruited. AHDB and Signet Breeding Services staff have also changed during the three years. Whilst this

has posed some practical challenges, the group have remained consistent and dedicated. This is testament to the group for maintaining excellent relationships, good communication, open attitude and a positive team approach. The group chairman has demonstrated excellent leadership and is a permanent advocate for the group.

Farming, particularly in the uplands, can at times feel very isolated. These social benefits, which include the community group and peer-to-peer relationships, are difficult to quantify but they must not be discounted. They have been invaluable throughout this project and will continue to provide the same for the wider farming community, the next generation and these vital rural businesses.

Skills and training

The group have been on a huge learning curve throughout the project which began with performance recording, technology and genetic evaluations. In 2018, at least one breeder had technology problems that unfortunately resulted in lost data – whilst this would impact evaluations, it is a mistake that was learned from and which others can also learn from in the future.

All members agree that they have also gained from personal development. This extends beyond the technical skills learned through performance recording and technology but, also through the wider benefits of the project. Results from the project have challenged mindset, traditional farming practices and response to change. Public speaking, group communication, challenging situations, leadership, team work, engagement with press and other industry bodies are just some of the other skills which have been developed by members.

8. Conclusions

We have successfully demonstrated that performance recording for genetic evaluation purposes is viable within an upland farming system. We have established a farmer network capable of demonstrating this to others across the industry through peer-to-peer learning. The group have developed credible links with agricultural industry and inspired a community group who are enthusiastic about the results of this project. Engagement across the open farm project days increased from 24 (2017) to 43 (2018) attendees all of which provided excellent feedback and demonstrated a growing interest in this rural topic.

The results (see section 5 - genetic and carcase data) show a clear difference in performance attributed to genetics in those animals that are otherwise deemed as acceptable based on breed type and functionality only – now genetics can complement and add value to this selection criteria. We also have a dataset that can demonstrate on-farm phenotypic differences in performance alongside corresponding EBVs and indexes in a hill environment. This is essential for future knowledge exchange. By doing so, we have also created a Hill Index specific to this group of breeders which can be either adopted or adapted by their peers going forward.

Using technology, we tested the 'stand-off' theory in the ultrasonic measurement of sheep to assess eye muscle area. This has been deemed unsuitable, concluding that current ultrasound technologies are both adequate and practical when being used to identify differences in loin muscularity.

We acknowledge that three years is not long enough to fully assess the impact of genetic improvement (see next steps – genetics). To overcome this, the breeders will continue to performance record, collect slaughter data and crucially, they will lead by example encouraging other upland hill flocks to do the same. The number of UK upland hill flocks who performance record has increased from 41 to 48 during the three year project.

Lamb finishing results (see section 5 – carcase & lamb finishing data) have shown that Swaledale lambs can meet desirable commercial carcase specifications but, at significant cost (*based on costings from the finisher farm only). There were large differences between sires in growth rate, carcase weight, carcase conformation, loin, and leg weights etc indicating the key benefits of performance recording when selecting rams to avoid these inconsistencies in the future. By selecting those rams with the desirable carcase traits, the group have improved carcase conformation - the caveat being, that data recording and informed selection must continue to confirm these early findings. Lamb carcase data shows 41% of lambs achieving R Grade which exceeds the groups initial aim to increase this percentage from 30% to 40%. However, 59% of lambs received O grade which is more typical for this breed. This early data should be used with caution as previously mentioned. The key learning here is that variation exists within the breed and therefore informed selection is critical – there are rams capable of providing improved carcase conformation without sacrificing breed type or function. These results (supported by increased data going forward) will provide breeders with the confidence to use this information (illustrated through EBV's) for their own breeding purposes and it may also allow opportunities in the future for Swaledale rams to be sold and purchased with supporting performance recorded data - an industry first for the Swaledale sheep breed.

When taking Swaledale lambs to heavier weights they tend to be 'overfat' (>3L), which suggests specialist finishing is required (or more research from feed trials – see comments in section 5 and below next steps). There was a wide range of days to slaughter/cost of finishing reflecting large differences between sires in lamb growth and efficiency of resource use. When lambs are moved from the farm of origin for finishing, performance is compromised in the first three months, in part due to stress and declining day length. High performance on farm related to high quality carcasses with some rams standing out consistently in all assessments.

Genetic evaluations translated into on farm performance, is of significant value to lamb finishers in terms of feed costs, days to slaughter and carcase value.

Next Steps – lamb finishing

If time and facilities had allowed, it would have been interesting to assess performance of lambs on different diets to see if lambs from the genetically superior sires performed well under all systems. For instance, could lambs from sire 9344 have performed equally well, if not better, on a forage based diet of stubble turnips as opposed to haylage and concentrates? Root crops and brassicas offer highly nutritious and very cost effective finishing diets for late born hill type lambs but, land in hill areas is not always suitable or available for growing these crops.

Low numbers of lambs were produced from some sires in this project making some comparisons difficult. Ideally, full costings should have been carried out including fixed costs for all farms in the project to better understand whether it is more profitable and sustainable for hill farmers to sell all surplus lambs as stores rather than finish them at home. Farmer D had decided on this approach a few years ago and had been sending lambs to the specialist finisher for some time. A possible solution would be for project farmers to send at least 20 lambs from each sire to the specialist finisher to compare all lambs under identical conditions. This finisher is very well equipped with an electronic handing and drafting system to accurately record lambs weights and to measure food intake on a group basis.

We have referred within this report to efficiency of resource use but, without individual feed intakes we have no way of knowing which animals have eaten less to achieve the same gain than other lambs i.e. which are truly most efficient. The Stabilser Cattle Company has demonstrated a 14% difference in feed efficiency between bulls – with the most efficient eating 14% less food than the least efficient. SRUC has mobile feed intake measuring equipment suitable for sheep and it would be interesting to assess a number of lambs from different sires in this way.

Next steps – genetics

The group will continue to performance record and share breeding stock in order to improve genetic linkage and connectedness (strengthening their breed evaluations). The group also have an interest in maternal performance which is a trait that will take longer to improve than growth and carcase due to the heritability of maternal traits and generation interval. However, it is a realistic aim and many other, longer recording breeds have demonstrated substantial improvements in maternal performance via the use of EBVs in a breeding programme. The first step would be for the group and Signet Breeding Services to establish parameters for what makes the 'best' ewe and what their breeding objectives are.

The group already plan to meet with the Welsh Hill ram scheme as soon as time allows to share ideas, experiences and discuss potential collaboration. This was supposed to happen summer 2020 but due to COVID-19, the decision has been made to postpone this until 2021. The group had also planned to attend the Swaledale Sheep Breeders Association Show (the society's centenary celebrations) in June 2020 to promote the project and its results. Unfortunately, this event has been postponed due to the ongoing pandemic but will hopefully be rescheduled.

9. Project dissemination

Year One (2017/18)

- Website to all share publications, press and further dissemination; https://ahdb.org.uk/beef-lamb/north-york-moors-swaledale-breeders-operational-group ****Please note** that AHDB have only recently updated their website. Content is currently being loaded by priority. Presentations & other project content is waiting within that process and all information will be available by end of June 2020. Information will be retained on this site until April 2025.
- First open farm project day held – Birk Nab Farm, High Lane, YO62 7TF, courtesy of Barry Wheldon, Tuesday 22nd August 12:30 – 3:00pm. See appendix G for event feedback summary.
- Steve Dunkley (AHDB Beef & Lamb) spoke at the Swaledale Sheep Association AGM in June 2017. Steve also spoke at the EIP workshop in July 2017.
- AHDB issued a press release in August about the project - http://beefandlamb.ahdb.org.uk/upland-farmers-acting-to-improve-productivity-of-hill-flocks/
- Farmers weekly ran an article in August on the project - http://www.fwi.co.uk/livestock/swaledale-breeders-signet-recording-increase-carcasses.htm
- Group Chairman Tim Dunn spoke at the Swaledale Sheep Association Council meeting to update them about the projects progress in August 2017.
- National Farmers Union and National Sheep Association were both sent details of the project aims and outcomes. Individual representatives from those member organisations engaged directly with group members and AHDB. This engagement continued throughout the project where regular updates were circulated and discussed.

Year Two (2018/19)

- Second open farm project day held **-** Breckhouse, Bransdale, Fadmoor, York, YO61 7JW, courtesy of Tim Dunn, Thursday 16th August 2018 12:00 - 3:00pm. See appendix G for event feedback summary.
- Northern Farmer article was published in Nov 18 edition after the open day which highlighted the project (see appendix F).
- Steve Dunkley (AHDB) spoke at EIP AGRI workshop held in York, June 2018.
- Sam Charlton (AHDB Beef & Lamb) has spoken to NFU livestock committee.
- 1:1 meetings were held to discuss the project with the Yorkshire Farmer Network and the Swaledale Sheep Breeder Association.
- Tim Dunn (Chairman) spoke to NSA vice chair Thomas Carrick and Neal Cole (Devon based producer).
- Newton Rigg College have started recording their flock of Swaledale sheep after learning about the project.

Year Three (2019/20)

- Final open farm project day held – Hunt House Farm, Goathland, North Yorkshire, YO22 5AP, courtesy of Mark Graham, Wednesday 2nd October 2019 12:00 – 3:30pm. See appendix G for event feedback summary.
- Group Chairman Tim Dunn presented at Sheep Breeders Round Table Seminar - https://ahdb.org.uk/news/take-the-future-of-the-industry-into-your-hands
- Farmers Guardian Articles reflecting on results from the final open day - https://www.fginsight.com/vip/vip/swaledale-sire-scheme-speeds-up-genetic-progress-101468 https://www.fginsight.com/news/news/lambs-from-top-swaledale-tups-worth-up-to-5-more-project-shows-95686
- Chairman Tim Dunn, Sam Charlton (AHDB Beef & Lamb) and Emma Steel (Signet) attended the Northumberland national park sheep group meeting on 19th Nov 2019 to discuss the project and its results.
- AHDB Press Release September 2019 – see other press articles (Appendix F)

10. Appendices

Appendix A

Terms of reference

NORTH YORK MOORS SWALEDALE BREEDERS GROUP

TERMS OF REFERENCE – 22nd Nov 2016 (Updated 19 Nov 2018 v3)

1. PURPOSE

   The group has been set up to oversee the development and management of a RDPE EIP grant bid. The aim of the project is to:

   - Develop new ways of data collection and new and novel data sets that can be used in genetic evaluations for hill sheep carcase traits through the use of EID, weighing/measuring, DNA, CT and ultrasound scanning technologies that suit hill farmers and hill farming systems.
   - Develop existing ultrasound scanning technologies designed to measure muscle depth across the loin to provide a measure of total muscle area as an alternative to expensive CT scanning.
   - Identify Swaledale sheep with better carcase traits (loin, hind leg and shoulder) and use them within a breeding programme to improve carcase quality and consistency.
   - Take lambs from the breeding programme and assess them through trialling finishing systems, including novel management practices, and through using alternative forages (roots, legumes, protein crops) and different diets

2. ROLES AND RESPONSIBILITIES

   The group will design, manage and lead delivery of the project. This will include:

   - Group members - Members will collate physical ewe and lamb performance data to provide to Signet Breeding Services for the purposes of the genetic evaluations and provide match funding
   - Tim Dunn, Breck House Enterprises Ltd - will be the applicant and manage the paying of invoices, tracking spend and bank rolling
   - AHDB Beef and Lamb – will act as agent, oversee the management of the project, liaise with Defra over progress reports and claims / audits and provide group meeting administrative / coordination
   - Technical leads - will include Signet Breeding Services who will provide the performance recording and data analysis function and Kate Philips who will provide sheep consultancy on nutrition, health and lamb finishing.

   The group is accountable for:

   - working cooperatively
   - maintaining a focus on the agreed aims and outcomes

   The membership of the group will commit to:

   - attending all scheduled group meetings, or nominate a deputy
   - championing the project
   - share information across the group
   - make timely decisions
   - notify members of the group if any matters arise which negatively affect the project

   Members of the group will expect:

   - that each member of the group will participate fully, and provide information / data in a timely manner
   - open and honest discussion about the direction of the project
   - to be alerted to risks and issues that could impact on the project

3. GOVERNANCE AND REPORTING

The group will be chaired by Tim Dunn who will provide leadership, develop consensus and conflict resolution. Secretariat will be provided By AHDB Beef & Lamb with agendas and reports circulated a week in advance. An annual review of ToR will be conducted to ascertain if they are relevant and fit for purpose. Any conflicts of interest must be declared at the outset, the proposer of any conflict of interest shall not be allowed to participate in any vote or discussion whereby their interest are, or could be, different from the best interests of the operational group itself.

4. CORE MEMBERSHIP AND FUNDING

The updated list of members, as of 19 November 2018, of the operational group are as follows. Members should attend regularly and deputies put forward where they are unable to attend.

1. Tim Dunn, Breck House Enterprises Ltd, Breck House YO62 7JW
2. Mark Graham, J W & H M Graham Ltd, Goathland YO22 5AP
3. Barry Wheldon, A H Wheldon, High Lane YO62 7TF
4. Andy Fawbert, A & L Fawbert, Farndale YO62 7LH
5. Richard Sellars, DW A & R Sellars, Sycamore Farm, YO18 8HL
6. Lewis Barraclough, Dale Head Farm, Rosedale East, Pickering, YO18 8RL
7. Samantha Charlton, AHDB Beef and Lamb, Askham Bryan College, YO23 3FR
8. Kate Philips, Coppice Farm, Shrewsbury, SY5 8DF

To match fund the project the group commit to providing the following indicative sums:

	Year 1	Year 2	Year 3
Tim Dunn	£1000-1200	£1800-2000	£2000-2200
Mark Graham	£600-700	£1100-1300	£1600-1800
Barry Wheldon	£1800-2000	£1900-2100	£1900-2100
Andy Fawbert	£1100-1300	£1000-1200	£1200-1400
Richard Sellars	n/a	£300-400	£400-£500
Lewis Barraclough	n/a	n/a	£400-£500

The terms of reference are effective from 7th March 2016 (updated 19 Nov 2018 v3) and will run to cover the period of the development, running and final monitoring of the grant aided project, to March 2020.

5. MEETING SCHEDULE AND OUTPUTS

- The intellectual property rights to the raw flock data belong to the farmer. AHDB will use this data to calculate Estimated Breeding Values (EBV) and to calculate various selection indices. The EBVs and indices will then be provided to the groups farmer members
- The farmer members agree that intellectual property rights in all results, knowledge or invention derived from their raw flock data will belong to AHDB
- All group members agree that the project results can be shared freely with non-group members
- The operational group will meet at least quarterly or as and when required in busy periods, the location to be agreed as being convenient to members of the group.
- Teleconferences may be used as alternatives (use of AHDB system).
- Meetings will be chaired and include feedback from group members as to progress and any issues identified as well as management reports provided by AHDB/technical leads.
- Decisions made by consensus, if not possible a vote will be taken where the decision is with the majority, if not, then chairman will have the final decision

- Non-members / observers will be invited to group meetings where they have specific expertise relevant to the project. (i.e. vets, Defra, processors).
- Confidential data will be circulated only in password protected files to protect business data and any financial information

6. DECLARATION

I/We the undersigned is a/are member(s) of the North York Moors Swaledale Breeders Group and agree to act in accordance with the working arrangements contained within the terms of Reference.

Name	Signature	Date

7. Signed by Chairman on behalf of the group:

Name	Signature	Date

Appendix B

Group members

Group Chairman;

Tim Dunn, Breck House Enterprises Ltd, Breck House YO62 7JW (*FARM B)

Group Members;

Mark Graham, J W & H M Graham Ltd, Goathland YO22 5AP – Group Member (*FARM D)

Barry Wheldon, A H Wheldon, High Lane YO62 7TF - Group Member (*FARM A)

Andy Fawbert, A & L Fawbert, Farndale YO62 7LH - Group Member (*FARM E)

Richard Sellars, DW A & R Sellars, Sycamore Farm, YO18 8HL - Group Member (*FARM F)

Lewis Barraclough, Dale Head Farm, Rosedale East, Pickering, YO18 8RL - Group Member (*FARM C)

Other members;

Samantha Charlton, AHDB Beef and Lamb, Askham Bryan College, YO23 3FR - Group Facilitator

Kate Philips, Coppice Farm, Shrewsbury, SY5 8DF – Independent Sheep Consultant

Supported by;

Signet Breeding Services Ltd, AHDB, Stoneleigh Park, Stoneleigh, Kenilworth, CV8 2TL

Website address for publications, presentations & results;

https://ahdb.org.uk/beef-lamb/north-york-moors-swaledale-breeders-operational-group

****Please note** that AHDB have only recently updated their website. Content is currently being loaded by priority. Presentations & other project content is waiting within that process and all information will be available by end of June 2020. Information will be retained on this site until April 2025.

Appendix C

Hill recording blueprint & EBV examples

When	What	How	Why
After tupping	Record **tupping groups.** Assign sires to Dams. Keep for later data entry. Set up Stock Sires Online.	**Single sire** each tupping group of pedigree animals.	To ensure pedigree data is correct. Families and their data can be connected on the database.
Lambing	**Date of birth** and **pedigree data (mandatory** from tupping group records. Litter size, lambing ease and birth weight (optional)	Collect information from tupping groups (EID tags and digital recorders are useful). This can be entered online, via excel sheet or paper. Please note paper records will need to be transferred to digital format before submission.	To record the animals pedigree and lambing details. At this stage the animal will enter the database.
6- 12 weeks (42-84 days) (Please note wide age range to allow flexibility)	**Eight week weight**- • Lambs must fall within the age range at date of weighing • Lambs can have two weights at this stage, an early and late to help with flexibility. • Timing falls at nematodirus treatment or other worming and vaccinations.	**Weigh lambs and record**- enter weights online or send to Signet (via excel).	Used to calculate: • Eight week weight- Growth Trait • Maternal Ability • Lamb Survival
Around 21 weeks or when all lambs are between 35-45Kg	**Scan weight**	**Weigh and record-** completed at the same time as **ultrasound scanning**.	Used to calculate: Scan Weight EBV - Growth Trait
Around 21 weeks or when all lambs are between 35-45Kg	**Muscle depth**	**Ultrasound Scan and Record** – carried out by a Signet approved scanning technician	Used to calculate: Muscle & fat Depth EBVs to improve carcass quality.
Pre- tupping for shearling	**Shearling weight**	**Weigh and record** shearling ewes	Used to calculate: Mature weight EBV- ewe efficiency
Pre- tupping for all Ewes	**Ewe Mature Weight**	**Weigh, BCS, and record**	Used to calculate: Mature weight EBV- ewe efficiency

At any point within the Year	**Census**	Remove any sold, dead or transferred animals from your records.	Keep your flock up to date. Make inbreeding and other flock management process easier.

Event	**Records Needed**	**Quick Timing Guide***	**Date**
Tupping	Tupping group (assign rams to individual ewes).	Lambing – 145 days	
Lambing	**DOB, Parentage, Fostering**, Birth Weight, Litter Size and Lambing ease.	Lambing	
Eight week weight	**Lamb Weight** and **Management Group**	Date of Birth + 84 days Maximum age +42 days Minimum age	
Scan Weight	**Scan Weight, Muscle Depth and Fat Depth**	Lambing +21 weeks All lambs need to be above 35kg	
Pre Tupping	Ewe shearling Weight	DOB + 18 months	
Pre Tupping	Ewe Mature Weight and BCS	Lambing -170 days	

*The timing guides are for the flock averages. Eight-week weight measurements must be taken within the age range. The age range is 6 weeks - if lambing extends over 6 weeks, then lambing can be split into early and late batch. Animals that are within the age range at both weighing can have two weights entered.

Eight-week weight EBV (kg)	Scan weight EBV (kg)
An indication of breeding potential for growth to eight weeks of age	An indication of breeding potential for growth at scanning time – typically 21 weeks of age
Example A ram with an EBV of +4kg is estimated to produce lambs which are 2kg heavier at eight weeks of age than a ram with an EBV of 0	**Example** A ram with an EBV of +6kg is estimated to produce lambs that are 3kg heavier than a ram with an EBV of 0

Muscle depth EBV (mm)	Fat depth EBV (mm)
An indication of breeding potential for muscling across the loin	An indication of breeding potential for fatness across the loin
Example A ram with an EBV of +4mm is estimated to produce lambs with loin depths 2mm deeper than a ram with an EBV of 0	**Example** A ram with an EBV of -1mm is estimated to produce lambs with 0.5mm less fat across the loin than a ram with an EBV of 0

Maternal ability EBV (kg)	Mature size EBV (kg)
An indication of breeding potential for maternal care, particularly milkiness	An indication of breeding potential for size at maturity
Example A ram with an EBV of +1kg is estimated to produce ewes whose lambs are 0.5kg heavier at eight weeks than a ram with an EBV of 0	**Example** A ram with an EBV of +8 is estimated to produce ewes which are 4kg heavier at maturity than a ram with an EBV of 0

Appendix D

Ram health protocol

Planned protocol

- Test rams for Border disease and Maedi visna one month before sending to other farm
- Check feet – vaccinate with Footvax?
- Give rams a full MOT

Movement protocol

- One week before moving treat with Cydectin 2% to protect against scab (60 days)
- Dose with Zolvix (4-AD) on leaving the farm and hold on new farm for 48 hours inside before letting out to grass
- Dose with triclabendazole for fluke
- Foot bath for footrot and CODD
- Repeat physical examination on return, worm and foot bath

**Protocol may vary according to the farms that the rams are moved to e.g. if rams are moving between Tim and Barry, then less need for treatments as they share grazing.

Kate Phillips

5th September 2017

Appendix E

Lamb health protocol

(Moving lambs from birth place for onward finishing)

Farm of birth

1. **Clostridial diseases and pasteurella**
    a. All lambs should be covered for pasteurella and clostridial diseases. This must include two vaccinations 4 to 6 weeks apart using either Ovivac P or Heptavac P. This can start any time after 3 weeks of age in lambs born to unvaccinated ewes, but could tie in with marking (6 weeks of age). For full protection from these diseases the second injection should be given 4 to 6 weeks later at 10 to 12 weeks of age. Perhaps give another booster before lambs leave the farm? (MG gives Ovipast at weaning).
2. **Orf**
    a. Scabivax given at marking if orf is an annual problem.
3. **Internal parasites**
    a. Ideally faceal egg counts should be monitored to find out if lambs need worming. If Nematodirus is a problem on the farm then can use a white (1-BZ) wormer for first dose (but better to use ML if BZ resistance). Alternate wormer types (1-BZ, 2-LV or 3-ML) in a season. Lambs should be weighed and dosed to the heaviest in the group. Also check the dosing gun to make sure it is delivering the correct amount. Ideally leave 10% of the best lambs untreated. Use an effective wormer – many farms have resistance to the white wormers (1-BZ) group so best to use an alternative. Find out which wormers working on each farm and ask farmers to record what is being used. Also worm as they leave the farm if FEC count dictates (Dectomax will cover worms and scab).
4. **External parasites**
    a. Dip or injectable ML for scab. Remember that a product like Dectomax – worms and treats scab so no need to drench as well if using. If using Dectomax for scab, then make sure to move lambs to a new field where scab infested sheep have not been kept for the last 17 days. Dip or pour-on for flies, ticks, lice as needed.
5. **Trace element supplements**
    a. Pre-weaning – at second Ovivac P injection, or as necessary according to farm deficiencies.

Lamb health calendar for farm of birth (assumes ewes not given Heptavac P +, if given vaccine can start Ovivac P from 10 weeks of age).

Month	Health issue	Treatment/prevention
May (marking)	Clostridial diseases and pasteurella	Ovivac P or Heptavac P 1st dose to all lambs
	Worms	White wormer for Nematodirus if needed
	Ticks etc	Pour-on e.g. Dysect
July (clipping)	Clostridial diseases and pasteurella	2nd dose Ovivac P (4 to 6 weeks after 1st dose).
	Worms	2-LV or 3-ML wormer if needed
	Trace element deficiency	Drench – Selenium and cobalt
August (weaning)	Pasteurella	Ovipast
	Ticks etc	OP dip
	Worms	As necessary with 2-LV or 3-Ml wormer
	Trace element deficiency	Drench/bolus
September	Scab/worms	Dectomax just before leave the farm

Finishing farm

Historically mortality in Swaledale store lambs has been high (due in the main to pasteurella and acidosis) so, every effort needs to be made to prepare lambs for moving and to minimise stress in the first few weeks on the new farm.

1. On arrival all lambs need to be turned out to grass and allowed to settle for 3 to 4 weeks. Pasteurella vaccine (who provides this is to be confirmed; origin farm or destination farm?).
2. Lambs can then be belly clipped and dagged.
3. Lambs split into groups by weight.
4. Lambs introduced to ad-lib concentrates at grass by first offering compound feed in 3 in1 feeders then making a slow transition to oats/barley/soya mix. Keep oats proportion high for a month; at least 30%. Haylage availability at all times.
5. Introduce fodder beet slowly by allowing lambs access to field but, not forcing them to eat. Fodder beet is as likely to cause acidosis as is ad-lib cereals so care needs to be taken when they are introduced.

Progress with project to boost growth and quality

A THREE-YEAR project which aims to improve carcase quality and growth rates in Swaledale lambs is currently in its second year, and local breeders gathered at one of the participating farms to hear about the latest developments.

The North York Moors Swaledale project was initiated by a group of farmers, who were keen to improve conformation and daily liveweight gains for their purebred finishing lambs. The concept was supported by AHDB Beef and Lamb, which brought in the organisation's Signet Breeding Services, to formulate a system for testing and evaluating tups and analysing data.

The main aim of the project is to improve Swaledale lamb carcases by an average of one grade, to produce a classification of R2 or R3 at 18kgs deadweight, along with a move toward shorter finishing times. It is hoped that improved carcase conformation will pass down to the North of England Mule gimmer lambs, which make a significant contribution to income for a large number of Swaledale flock owners. These targets must be reached without compromising either 'type', an important element for pedigree Swaledale breeders, or maternal traits.

Grant funding was secured for the trial through the European Innovation Partnership and some has been invested in EID systems, to track lamb performance. Weigh results are run through a software programme, which works out daily liveweight gains.

One of the founder members of the three-year project is Tim Dunn, who hosted a meeting at Breck House Farm, Bransdale, near Helmsley. Mr Dunn explained to delegates that the regime for testing tup performance had been specifically designed to suit hill flocks.

IN ITS SECOND YEAR

Breeders gathered to hear about the three-year North York Moors Swaledale project. Wendy Short joined them.

"There are many challenges to be faced with the recording of hill sheep and we have worked together, to develop a simplified system which fits into our management programmes," said Mr Dunn.

"We were already recording the parentage of our pedigree lambs and instead of weighing individuals at birth, we categorise each animal as small, medium or large. The lambs are also weighed at eight weeks and 20 weeks, as well as being scanned using an ultrasound system.

"Data is still being gathered and it will take two to three generations, before we expect to see significant changes in production levels. However, we have been so encouraged by the results that have been achieved to date that we are replicating the trial on our small pedigree Bluefaced Leicester flock."

Mr Dunn stressed that Swaledale type would continue to have a strong influence on tup selection.

"We will use growth rate information in the selection of our tups, but chosen sires will also have to conform to the traditional goals of our Swaledale breeding programme. It has been very interesting; because a visual comparison of two of our best tups might show the animals to be very similar, but studying the figures will demonstrate that one has much greater potential for the production of quality lambs with high growth rates."

The project has already made considerable progress, having identified a number of top-performing tups whose lambs were up to 3kgs heavier at the 21-week ultrasound scanning date. The top five per cent rams that have been identified have sired lambs with weights which exceeded 25kgs at 19 weeks.

Signet's Emma Steel told the audience that four farms were participating in the programme and that more than 800 lambs had been tracked, with 25-plus sires tested in 2017. These would be used for repeat breeding programmes, to improve accuracy of information.

She commented that ultrasound scanning to provide detailed information on carcase traits was expensive in sheep; a relatively low value animal. In addition, it was generally accepted that the scanning of hill sheep was particularly difficult, due to problems with the contact of the probe and the loin area, said Miss Steele. Research was being undertaken, in an attempt to enhance the technique. An EBV for Swaledale tups was being produced and it was hoped that additional producers will put their flocks forward for the testing scheme, she said.

Breck House Farm

Breck House comprises almost 500 acres of a mixture of owned and rented land, supporting a flock of 700 pedigree Swaledale ewes, a proportion of which are put to the Bluefaced Leicester.

Tim and Sarah Dunn work alongside son James to produce Swaledale finishing lambs and Mule breeding

■ Turn to page 34

New data to be shared on productivity of hill flocks

First year data from a project aiming to improve the productivity of hill flocks will be discussed at an event on 16 August in North Yorkshire.

Launched in 2017, the North York Moors Swaledale Breeders Operational Group, which is funded by Defra and EIP Agri and with the support of AHDB set up a project that looks to improve carcase traits of swaledale sheep with the aim of creating a template for hill sheep performance recording.

The free event will offer an opportunity to find out the latest on the first year of data collection, which has been conducted through the use of technology including weighing scales, electronic identification and ultrasound scanning.

Emma Steele, Signet Breeding Specialist said: "We've been looking at ways in which we can improve growth and carcase traits in a structured breeding programme that will help us to improve overall profitability of hill farming systems. However, we must not do this at the expense of maternal traits and the project also records and aims to improve maternal characteristics.

"It is arguably much harder to collect this level of data in a hill farming environment than lowland flocks but everyone involved is really keen to find out how this may help them to improve productivity and the genetics of their flocks while demonstrating data collection methods that can be more widely rolled out across the hill farming sector."

The event will also offer attendees the opportunity to watch an ultrasound scanning demonstration, as well as hear about lamb finishing, health and nutrition for the next year of the project from independent sheep consultant Kate Phillips.

24 September 2019

North Yorkshire Swaledale Breeders' Group unveil three year project findings

How to improve lamb growth rates, carcase quality and chose rams with traits that meet consumer demand will be showcased at a meeting in Goathland, Whitby on 2 October.

Findings from a three year project, formed by the North Yorkshire Moors Swaledale Breeders Group, will also look at how farmers can adopt upland hill performance recording techniques within their own flocks.

Sam Charlton, AHDB Knowledge Exchange Manager, said: "This is an innovative project which is looking to address some of the key challenges upland farmers face with performance recording sheep flocks. The producers involved are developing solutions that other hill producers can adopt, whilst also improving the carcase traits of their Swaledale sheep so they can meet the growing demands of the market. It has been a privilege working with this enthusiastic group of farmers and we are delighted to now share the results with the wider industry."

On 2 October, farmer Mark Graham and the rest of the Swaledale Breeders' group will be hosting the final open day for the project. On the day, some of the Swaledale sheep used in the project will be available for viewing and live demonstrations including sheep scanning, and lamb selection. There will also be a butchery demonstration.

In 2016, with the help of AHDB, the North Yorkshire Moors Swaledale Breeders' group secured EIP AGRI funding through the European Agricultural Fund for Rural Development (EAFRD), which is administered by Defra. The project has involved selecting Swaledale rams, which are identified as having better carcase traits (using loin, hind leg and shoulder), within a structured breeding programme to improve carcase quality and consistency.

"Lamb finishing has been monitored on three of the group member's farms and on a specialist lamb finishing unit. We have highlighted some major differences between sires in terms of lamb growth rate and carcase

quality and have some interesting findings to share with regards to pattern of growth in Swale lamb," said Kate Phillips, Independent Sheep Consultant for the group.

The group of Swaledale farmers were determined to test the practical challenges of performance recording in the uplands and through working with Signet Breeding Services, the group have successfully demonstrated significant performance differences between Swaledale rams. "This means the breed now have the ability to select breeding lines that not only represent breed type, but whose progeny will also excel in growth and carcase characteristics," said Emma Steele from Signet Breeding services.

Tim Dunn, Chair of the North Yorkshire Swaledale Breeders group, said: "After breeding Swaledale sheep for many years, we feel a need to maintain and build on the many qualities the breed has. With the continued focus on meeting market requirements, it is important we keep pace with other breeds and this work to improve carcase traits will help us stay at the forefront of sheep breeding in the UK."

The work of the North Yorkshire Moors Swaledale Group forms part of AHDB's Farm Excellence Platform, which inspires industry to improve performance and succeed through farmer-to-farmer knowledge exchange.

To find out more about the event visit our website https://ahdb.org.uk/events/north-yorkshire-moors-swaledale-group-final-year-open-day

LIVESTOCK

Edited by Katie Jones – 07786 856 439 – katie.jones@fginsight.com

Results from a three-year project aiming to improve carcase quality and growth rates in Swaledale lambs have shown progress can be made using a simple recording system. **Wendy Short** reports.

Lambs from top Swaledale tups worth up to £5 more

More than 2,000 lambs analysed

A SIMPLIFIED recording system, which was specifically designed by farmers for their own Swaledale flocks, has proved a useful tool to aid the selection of rams, highlighting the limitations of choosing sires by visual judgement alone.

That was the conclusion of a project driven by a group of Yorkshire producers which monitored lamb growth rates and collected data from muscle and fat scanning, as well as abattoir feedback.

The North Yorkshire Moors Swaledale Breeders Group project, which concluded this month, is now seeking to extend the recording programme and is looking for new members.

A project wind-up meeting was held recently at Hunt House Farm, near Whitby, which is run by project member Mark Graham, who farms 1,300 pure-bred Swaledales in partnership with his brother-in-law Ian Thompson.

Speaking at the meeting, independent sheep consultant Kate Phillips explained the project used data from six participating farms, with information generated by the recording of more than 2,000 lambs analysed by Signet Breeding Services.

Mrs Phillips said: "The information to date shows rams which fell in the top 10 per cent for performance figures produced lambs worth an estimated £3-£5 more than rams in the bottom 10 per cent.

> There was also a 3kg differential between the heaviest and lightest lambs at second weighing
>
> KATE PHILLIPS

"It found a difference of as much as 2kg between eight-week-old lambs from the best sires and the progeny of poorer rams.

Variation

"There was also a 3kg differential between the heaviest and lightest lambs at the second weighing and a wide variation in muscle and fat scan depths. Our figures show type does not need to be sacrificed, as some of the best rams are also considered the best examples of the breed on visual appearance.

"Nevertheless, artificial insemination is not a practical option for most upland farms and this is a limiting factor, in terms of the potential for genetic progress."

Maternal characteristics had also been taken into account, she stressed.

"Signet analyses show the top rams also have the potential to breed females with good mothering ability and milkiness," she said.

"A comparison of two rams showed the sire with the best-performing lambs had a score of 0.46 for maternal ability, while the poorer animal was allocated a figure of -0.25."

The challenges of sire recording in a hill farming situation had been largely overcome by the adaptation of standard systems, explained project chairman Tim Dunn, who farms near Helmsley.

AHDB Beef and Lamb, which supported the project, had secured funding to supply farms with EID systems and the sheep were divided into separate management groups.

As an alternative to weighing the lambs at birth, they were categorised as small, medium or large.

On Mr Dunn's own farm, the traditional eight-week lamb weight recording period was replaced with a date which fitted in with the annual gather for shearing, with the figures adjusted by Signet to provide a comparison across participating flocks.

Back fat scanning and a second weighing were carried out at 21 weeks and a limited number were followed through to slaughter.

"Our members have been instrumental in developing a process which suits their practices and therefore the amount of extra work that has been generated has been minimal," said Mr Dunn.

"One ram stood out because his lambs were the heaviest at the onset of the finishing period, despite having produced a greater number of twins.

"He also scored highly for lambs which met carcase specification, while another ram had a marked reduction in lamb days to finishing."

Mr Dunn added the Swaledale lamb has come in for 'some criticism', but he believed these trial results pointed to its potential to achieve the desired market specification.

Profitability

"As pedigree breeders, we are already using individual sire matings and we have records going back for generations," he said.

"It is important we keep pace with other breeds. It is in our own interests to produce accurate figures, as our future profitability is linked to the performance of our own stock and of the sheep that are sold off the farm."

The economic benefit of having figures to accompany Swaledale rams which were offered for sale had been highlighted by the study, said Mr Dunn, and there was an opportunity for rams which had been evaluated as part of the project to be traded within the group.

In the meantime, members were planning to hold further meetings, to discuss how the project might be continued.

"In my opinion, we need to monitor at least two generations of sheep, in order for a true picture to emerge," Mr Dunn said.

"That will take at least a decade and the information will be more valuable if additional flocks are entered into any scheme that might be developed in the future."

Tim Dunn

COMPARISON OF TWO SIRES IN THE SAME FLOCK

	Ram A	Ram B
Average lamb weight at scanning (kg)	36.4	33.9
Average muscle depth (mm)	19.51	17.81
Average fat depth (mm)	2.3	1.65

Source: North Yorkshire Moors Swaledale Breeders Group

Rams in the top 10 per cent of performance figures produced lambs worth more than other rams.

Appendix G

Summary of feedback – open farm days

Swaledale Project – open farm day, 22nd August 2017

(Birch Nab Farm, High Lane, Pockley, York, YO62 7TF)

This event was attended by 24 people, 18 were captured through feedback.

Questions	Attendee answers
Overall opinion of event: Excellent = 4 good = 3 fair =2 Poor = 1	The average score from the 18 attendees was 3.7.
Were the speakers knowledgeable (yes/no)	100% of the attendees who answered this question answered yes.
Improved understanding (yes/no)	One attendee did not answer this question, the other 17 attendees (94.4%) answered yes.
Did the event give you any practical ideas (yes/no)	One attendee did not answer this question, the other 17 attendees (94.4%) answered yes. **If yes, please give brief details of what you will do:** • Think about supporting this group and others like it • Using performance recording in BFLs • Concentrate on reducing expenses finishing lambs • Would like to look into more performance recording sheep • Try implement more progressive recording of performance and development • Potential performance recording and ration formulation • Attend next meeting • Use programme recording. Monitor fattening systems • Look more closely at EBV values for rams • Very timely as we are looking at how we go forward with our sheep at present • Possibly offer rams to ram compare
Additional comments	• Very impressed with content of project and attention to detail

Swaledale Project – Open farm day, 16th August 2018

(Breckhouse, Bransdale, Fadmoor, York, YO62 7JW)

This event was attended by 43 people, 22 were captured through feedback.

Questions	Attendee answers
How likely to recommend this event?	The average score from the 22 attendees was 8.3. **Main reason for score:** • Don't know many hill farmers, not sure it's too applicable outside that • Very interesting and progressive information • Good information re EBVs • Very informative • Informative, subject of interest • Only if they were recording sheep • You always learn something from these events & talking to people who look at things from another angle • Quite a lot to take in, need to have an understanding of the breed for it to be beneficial • Well presented, hands on • Farm all swales • Very informative • Interesting
Were speakers knowledgeable?	• 100% of the 22 attendees answered yes.
Did you improve your understanding of the topics?	• One attendee answered no, the other 21 attendees (95.5%) answered yes. • Comments • On back fat cover and selection for fatness • Good
Did it give you practical ideas?	• One attendee did not answer this question. Three attendees (13.6%) answered no; the other 18 attendees (81.8%) answered yes. **Comments:** • Just not that appropriate for my business • Feeding weather lambs • Group tupping • Keep open mind on EBVs
Additional comments	• Will be interesting to see next year's results

Swaledale Project – final open farm day, 2nd October 2019

(Hunt House, Goathland, North Yorkshire, YO22 5AP)

This event was attended by 43 people, 32 were captured through feedback.

Questions	Attendee answers
How likely to recommend this event?	The average score from the 29 attendees who answered this question was 9.3. **Main reason for score:** • Keep project going • Unique choice of topic, informative • Very informative and interactive. Great debates between the group • Informative • Very well presented and organised on a topic of interest to me. • Very interesting and informative • Superb positive message Great need within this sector • Very informative • Wide variation of topics, talks, demonstrations • Excellent presentations • Some very useful points regarding the use of data to improve breeding for carcasses and returns for the business • Very well run event • Very interesting and informative • Excellent - technical content and messages • Good information and great speakers • Nice size of group, good location, variety of people taking part. Good learning opportunity • Industry needs more innovation in this field especially in hills
Were speakers knowledgeable?	100% of the 32 attendees answered yes. **Comments** • Very clear and passionate • Kate P excellent as ever
Did you improve your understanding of the topics?	100% of the 32 attendees answered yes. **Comments** • Similarities to my research • Use of data
Did it give you practical ideas?	Two attendees did not answer this question. The other 30 attendees (93.7%) answered yes.

	Comments • Good props e.g. Foam comb, I want one
Additional comments	• Run more in other areas. e.g. different swale districts • Keep it going, meet every 2 years to report progress • Great day. Very positive message. Well done to all 6 farms • Have meeting in another area with members of existing group as speakers • Perhaps more information on easy data collection • Good use of our levy

Appendix H

Project photographs (sample)

Final Open Day 2nd October 2019 pictures;

Appendix I

Social media examples

You Retweeted

Nicci Welch
@NicciWelch97

Fantastic afternoon at Hunt House Farm with @AHDB_BeefLamb and the North Yorkshire Moors Swaledale Breeders group discussing the improvement of carcase traits within the Swaledale breed. Thanks to all involved!

You Retweeted

John Ordidge
@johnordidge

Fantastic @AHDB_BeefLamb meeting today in Goathland discussing the Swaledale recording program. Really interesting results on something that will make a huge difference. Thanks to all involved

7:46 PM · Oct 2, 2019 · Twitter for iPhone

4 Retweets **13** Likes

You Retweeted

Sheep Breeders RT
@SheepBreeders19

Tim Dunn, Chairman of the North York Moors #Swaledale Group will speak about what a group of E District breeders are doing to ensure sheep production in the hills is productive to conclude session 1 of #sbrt19 @AHDB_BeefLamb @natsheep @HybuCigCymru @qmscotland @iSAGE_H2020

Emma Steele
@EmmaSteele1995

Join us 2nd October in N. Yorks for the final open day from the 3 year #Swaledale project with @AHDB_BeefLamb, @aksteele69 and Kate Phillips. Booking essential, secure your place here ahdb.org.uk/events/north-y... @barrywheldon @SamBoonBreeding @Jostwest #signetrecorded

You Retweeted

Barry Wheldon
@barrywheldon

One of our first recorded 5 shear tups to go to Ruswarp ram sale 4/10/19

Appendix J

Glossary of terms

EBVs – estimated breeding values. Individual values for traits measured estimating genetic merit. EBVs are calculated using a computational procedure known as BLUP (Best Linear Unbiased Prediction). EBV calculation (for cattle and sheep) involves solving a set of simultaneous equations where the unknowns are the genetic value of the animal and the environmental effects on its performance. Please visit the signet website here if you would like to learn more: https://signetdata.com/technical/beef-genetic-notes/how-ebvs-are-calculated/

Genetic evaluations – the process of turning raw measurements into estimates of genetic merit based on EBVs and Indexes.
Performance recording – the dataset required to be collected on farm by breeders for genetic evaluation.

Data deadlines – deadlines set by Signet Breeding Services for submission by the breeder. There are typically three of these a year.

Index – collection of commercially important EBVs, weighted according to value, to create one single number to allow animals to be compared against each other by the breeder. Indexes also help avoid single trait selection which can be detrimental.

Accuracy – the accuracy value indicates how much we know about an animal and its relatives for a specific trait. This is expressed between 0 - 99% with 0% being we know nothing about the animal, little or no performance recorded data and EBV predictions are poor. 99% accuracy represents EBVs with the most performance recorded data behind them and EBV predictions are high. Accuracy allows breeders to make risk based decisions based on the total amount of information held about an animal in relation to the trait in which it's being assessed (EBV).

Connectedness – a process of evaluating the genetic link between flocks. Achieving an 'acceptable' link allows flock comparisons to be made more accurately.

Adjusted eight week weight – weight of a lamb in kg measured between 42 – 84 days of age then adjusted to 56 days of age.

Eight week weight – weight measurement recorded between 42 and 84 days of age.

Ultrasound scan – ultrasound scan at the third lumbar vertebra to measure fat and muscle depth at a standardised point of the loin, typically done around 21 weeks of age

Birth notification – the action of a breeder informing Signet that a birth is to be recorded.

Scan weight – weight measurement taken immediately before the ultrasound scan, usually by an accredited scanning technician

Muscle depth – deepest point of the eye muscle in the loin determined by ultrasound scan.

Fat depth – average depth of fat across the top of the eye muscle determined by ultrasound scan.

Litter size – the number of lambs born to a ewe.

Litter size reared – the number of lambs reared to eight weeks of age.

Maternal ability – maternal element of lamb growth e.g. has the lamb grown well because genetically its growth rates are superior, or because its mother was particularly milky and attentive. The element of lamb growth attributed to maternal performance is known as 'maternal ability'.

Maternal traits – predominantly used by breeders who are selecting animals for breeding.

Terminal traits – predominantly used by breeders who are selecting animals for finishing (slaughter).

CT scanning – computed tomography scan is a full body image of the animal. This is used to assess full body composition and is the same technology used in human medicine.

Stand-off - a gel pad positioned between the animal and the ultrasound probe ensuring contact between the two surfaces.

Killing out percentage – the carcase weight expressed as a percentage of the liveweight at slaughter.

Food conversion efficiency – the amount of food (dry matter) eaten per kilogramme of live-weight gain.

EUROP grid – the carcase classification scale used to describe the quality of lamb carcases by carcase shape and fat cover.

DLWG – daily liveweight gain (achieved by the animal).

EGENES – https://www.sruc.ac.uk/info/120275/egenes

Signet Breeding Services - https://signetdata.com/