KTIF Final Report Template

Contents:

1. PROJECT TITLE/APPLICANT

1.1 Title

Feeding for Fertility in the Suckler Herd

1.2 Overview of your company

SAC Consulting has been the lead organisation for this project. SAC Consulting is a division of SRUC.

2. EXECUTIVE SUMMARY

2.1 Overview – Maximum 1 page

This project was designed to investigate the nutritional status of suckler cows over the 2020 calving period through metabolic profile (MP) testing and whether that could be linked to subsequent fertility. MP testing has had very little uptake in suckler herds and tends to only be carried out pre-calving. Therefore, post-calving MP tests have not been carried out in Scotland prior to this project.

Twelve farmers located in Angus and West Fife volunteered to take part in the project, with some being part of the Operational Group. Fifteen cows in each herd underwent MP testing approximately one month before calving and one month after calving to assess nutritional status. The MP tests analysed various parameters in blood to determine energy, protein and mineral status. Cows were also body condition scored at the same time. Nutritional management and body condition score (BCS) are important for a successful calving and subsequent fertility.

Farmers received detailed reports on their herd's MP results, nutrition and fertility data. Some of the key findings from the pre-calving MP tests that could impact on health and fertility were:

- One third of cows were deficient in magnesium.
- Over 60% of cows were struggling with their energy status.
- Around 50% of cows were short of dietary protein.

Post-calving results were slightly better but there was still evidence of sub-optimal nutrition:

- One quarter of cows were deficient in magnesium.
- Thirty seven percent of cows were in poor energy status and had lost significant body condition over the calving period.
- One fifth of cows were deficient in dietary protein.

The effect of nutritional status at calving time on subsequent fertility was investigated through pregnancy diagnosis information in late 2020 to identify how many animals in the herd were pregnant and not in-calf (empty). It was important to determine whether the trial cows were pregnant and if not, was there a reason that was highlighted in the MP tests over the calving period that could explain infertility?

It was difficult to link MP test results to subsequent fertility, with 95% of trial cows confirmed in-calf. Many cows with poor nutritional status over the calving period still got back in-calf, likely due to farmers taking corrective nutritional action, i.e., increasing concentrate feeding post-calving in cows with poor energy status and significant body condition loss may have helped prevent further condition loss, increasing their chance of getting pregnant.

Calving dates and historical fertility data were used to calculate key performance indicators to compare against industry benchmarks and provide farmers with recommendations for improvements. The following key performance indicators were benchmarked:

- Percentage of cows calving in the first 3, 6 and 9 weeks of the calving period.
- Herd average calving interval and % of cows with a calving interval below 370 days.
- Percentage of cows in- calf and percentage of empty cows.
- Percentage of calves weaned per 100 cows put to the bull.

Three on-line meetings were held throughout the project, two of which were for the participating farmers to discuss nutrition, BCS and MP test data, with herd fertility data covered in the second meeting. This allowed farmers to compare their results and discuss differences in management practices with each other, as well as learn from consultants and vets. A final open webinar was held where the project findings were summarised, and MP testing was discussed on how it could benefit nutrition and management to help improve herd fertility and calf output. Other project outputs included various press articles, three Technical Notes and a podcast.

3. PROJECT DESCRIPTION

Feeding the suckler cow is one of the largest costs in the beef industry. Existing research suggests that over one third of cows do not calve at the target BCS and are at least half a point away from the guidelines (on a 5-point scale). This has implications for calving ease, calf survival and subsequent fertility. Therefore, there is a great need to improve the use of feed resources at calving time.

The farmers involved in this project see improving calf output (fertility) as a priority and nutrition is a key area that they feel they can control. In the project MP data was analysed pre- and post-calving on 15 cows on 12 farms located in Angus and West Fife. Post-calving nutritional status, based on MP data, has not been investigated in suckler cows before, although it is a commonly used management tool in dairy herds to assess nutrition. This project aims to link this nutritional status information with nutrition and body condition score (BCS) change, to fine tune nutritional management practices that will improve subsequent fertility in suckler herds. Herd fertility was assessed from pregnancy diagnosis data in late 2020 in conjunction with MP test results and historic fertility data was benchmarked and recommendations provided on key areas to target for improvement.

This project involved collaboration with local two vet practices (Thrums Veterinary Practice in Kirriemuir and Cameron & Greig Veterinary Practice at Milnathort), expertise from SAC Consultants and SRUC Researchers. The University of Edinburgh was also a key partner in the project with veterinary expertise from Alastair Macrae at the Royal (Dick) School of Veterinary Studies who runs the University's Dairy Herd Health and Productivity Service (DHHPS) where the MP analyses were carried out.

All farmers received written feedback throughout the project on herd nutrition and their MP test results, both from the DHHPS MP testing scheme and a more detailed report on rations and mineral supplementation in relation to requirements from SAC Consultants. This allowed farmers to adjust nutrition accordingly if deficiencies were evident to try and prevent any health

issues in the cows at calving time and reduce and correct body condition loss – a key factor influencing herd fertility. The farmers acted on the back of the results and because of this it is very likely that this benefited herd fertility and achieved getting more cows in calf.

Reports with recommendations on areas to target for improving herd fertility and calf output were also provided on the back of pregnancy scanning information and historic herd fertility data. The percentage of calves weaned per 100 cows put to the bull is a key benchmark in suckler herds as it takes into account both cow and bull fertility, as well as calf losses and is heavily related to suckler herd profitability; the more calves weaned, the more profitable the herd.

Two discussion group meetings and an open webinar were organised to allowed those involved in the project to discuss results and learn about different management practices with other farmers, as well as benefiting from the vets involved.

This project produced a number of other outputs, including three SRUC Technical Notes covering the benefits of MP testing, nutritional management at calving and breeding management of heifers. A podcast was produced with one of the participating farmers and his vet and various press articles were published to raise awareness of the importance of nutrition over the calving period and how it can affect subsequent fertility, calf output and profitability in the suckler herd.

4. FINANCE

4.1 Sum awarded

The total sum awarded for this 1-year project was £74,429.

4.2 Detail of spend

The full project budget has been spent. This has been presented in claim forms submitted to the Scottish Government.

4.3 Noting any underspend and explain why

Project fully completed, all budget used, with no underspend.

5. PROJECT AIMS/OBJECTIVES

5.1 Linking what was set out in the application

This project aims to assess the nutritional status of suckler cows both pre-calving and post-calving and link this along with changes in body condition score (BCS) to fertility. This will be carried out through analysing metabolic profile (MP) data pre- and post-calving. Post-calving nutritional status using MP data has not previously been investigated in suckler cows. The aim is to link this nutritional status information with the rations being fed, along with BCS change, to fine tune nutritional management practices that will improve subsequent fertility in suckler herds.

The above project aim was achieved by recruiting 12 suckler farmers to take part in the project through two local veterinary practices on the back of discussion/benchmarking groups set up by the vets. There was great interest in the project as nutrition is seen as one of the most important factors influencing calving performance and fertility in suckler herds. These two

groups of farmers were targeted in late 2019, in preparation for the 2020 calving period. Farmers were keen to know the nutritional status of their herd through MP testing as none of them had carried this out before. This was achieved by the practice vet visiting these herds and blood testing 15 cows approximately one month before and one month after calving. Body condition scores of these cows were also taken at the same time and cows were weighed if there were facilities on farm to do so. All nutritional information including forage analysis, mineral supplementation and rations were collected and reviewed in relation to the MP results. Eleven out of the twelve herds carried out pregnancy diagnosis (scanning) later in 2020. The herds' fertility data (which included whether the 15 trial cows were back in calf), was investigated in relation to the nutritional status and MP results over the calving period to try and link nutrition at calving time with subsequent fertility.

Objectives in application
Detailed objectives were as follows:

1. To investigate the links between nutrition pre- and post-calving in suckler herds and subsequent fertility through dietary information, forage analysis and analysing data form MP tests pre- and post-calving.

2. To determine the effect of change in body condition score between the pre- and post-calving period on fertility.

3. To use the findings from these commercial suckler herds to produce practical recommendations on feeding management for future calvings to improve both technical and financial efficiency.

4. To update recommendations to the industry on nutrition and management of suckler cows to maximise fertility and calf output.

6. PROJECT OUTCOMES

6.1 How aims/objectives were achieved

1. To investigate the links between nutrition pre- and post-calving in suckler herds and subsequent fertility through dietary information, forage analysis and analysing data from MP tests pre- and post-calving.
This was achieved by MP testing 15 cows from each herd pre- and post-calving and relating this information to the rations fed and herd fertility status from pregnancy diagnosis data later in the year. These 15 cows were selected based on parity and expected calving date (no heifers were included; cows were to be less than 10 years of age and were expected to be calving in a very short period together).

2. To determine the effect of change in body condition score between the pre- and post-calving period on fertility.
Body condition scores of the 15 trial cows on each farm were taken when cows underwent MP testing before and after calving. This information was used to determine the extent of body condition loss over the calving period. Body condition loss is thought to be a key influencing factor on the ability of cows to get back in calf. While it appeared that many cows lost more than one unit of body condition score over the calving period (which is more than desired), the majority of these cows did get back in calf. However, it is unknown whether these cows took longer to start cycling after calving and hence get back in calf later compared to the rest of their herd mates. It will only be possible to determine this based on calving dates in 2021 (which is beyond the timescale of this project).

3. To use the findings from these commercial suckler herds to produce practical recommendations on feeding management for future calvings to improve both technical and financial efficiency.
Results from the MP tests have been used to improve knowledge and understanding in the area of sucker cow nutrition both pre- and post-calving. As MP testing in suckler herds has not previously been carried out post-calving (and is a rare management procedure pre-calving in suckler herds), the results were of great importance to gain an insight as to whether suckler cows are under nutritional stress in late pregnancy and in the early lactation period. Post-calving, it is often difficult to know the exact nutritional intake of cows when they are out at grass (where grass intake and quality are often unknown). The low magnesium in a number of cows both pre- and post-calving has been an interesting finding and an important one to highlight to the industry about the importance of adequate magnesium supplementation. This is crucial pre-calving to prevent "slow calving syndrome" and especially important post-calving to prevent grass staggers which is often a fatal condition if not detected early.

4. To update recommendations to the industry on nutrition and management of suckler cows to maximise fertility and calf output.
Industry recommendations on MP testing over the calving period for suckler cows have been highlighted through a Technical Note produced by SAC Consultants in conjunction with the University of Edinburgh. Another Technical Note on improving nutritional management of suckler cows has also been produced. One of the factors affecting overall herd fertility is how heifers are managed into the herd and whether they calve as 2-, 2.5 or 3-year-olds has a huge bearing on their fertility as cows. Advice on managing heifers to calve as 2-year-olds into the suckler herd to safeguard good fertility is covered in another Technical Note. These Technical Notes have been made available to the farmers involved in this project and to the wider industry through the SAC Consulting and Farm Advisory Service (FAS) website. They can also be used at future on-farm events and for SAC Consultants to access to advise their farmer clients.

The use of MP tests in this project proved beneficial, not only to help improve nutritional status but also for detecting underlying health issues such as fluke. It is important to highlight that these tests are available to suckler producers and the benefits they can have when used to rectified nutritional deficiencies that could impact on poor conception rates, embryo survival and being able to produce a live calf.

6.2 Milestones

Initially it was hoped that the project would have been completed by December 2020. However, many herds do not carry out pregnancy diagnosis until late November, which did not leave sufficient time to gather the data, analyse and plan on-line events to discuss the results. Therefore, an extension was granted until the end of February 2021 to allow the project to be completed. The key milestones throughout the project were achieved as follows:

November/December 2019 – recruit 12 farmers for the project through two farmer discussion groups (Thrums Veterinary Practice Suckler Group and West Fife Beef Group).

January 2020 - Farm visits to obtain herd management and ration information from participating farmers.

January/February/March 2020 - Farm visits by vet for MP tests to be carried out on 180 cows from 12 herds (15 cows per herd for data analysis) approximately 1-month pre-calving. Cows will also be body condition scored at this visit by the vet and weighed if possible.

March 2020 - Data analysis on nutrition, BCS and MP data, with feedback report provided to the farmers. An example pre-calving report is included in Annex 1.

March/April/May 2020 - Vet visits for MP tests to be carried out on the same 180 cows approximately 1-month post-calving. Cows will also be body condition scored at this visit by the vet and reweighed.

April/May/June 2020 - Data analysis on nutrition, BCS and MP data, with feedback report provided to the farmers.

July 2020 - Interim discussion group meeting with participating farmers to discuss findings from MP data and calving information. This was carried out as an on-line meeting (through GoTo Webinar).

November/December 2020 - Pregnancy diagnosis results from these herds were collected and examined and herd fertility was related to MP test results/body condition scores and nutrition in the trial cows over the 2020 calving period. All farmers received a detailed report on their herd's fertility and recommendations for improvements by January 2021. An example fertility report is shown in Annex 2.

January 2021 - On-line discussion meeting for participating farmers to discuss herd fertility data.

February 2021 - Knowledge exchange meeting open to all suckler producers and industry representatives to present project findings, with guest speaker (Alastair Macrae) to discuss the importance of MP testing in the suckler herd, nutritional influences on fertility and reducing calf losses.

February/March 2021 - Write up final report and disseminate information in a variety of ways to industry through press articles, podcast and technical notes.

7. LESSONS LEARNED

7.1 Issues/Challenges

One of the main issues arose when the pre-calving MP test was carried out. Some of the farms outwintered cows and took them inside roughly three weeks before calving. When the cows came off the hill and were housed, they were due to be blood sampled early the next day. Unfortunately, in some instances there was very little silage provision in the 24 hours prior to sampling and this could have affected the results of the MP test, with cows appearing to be in poorer nutritional status than they actually were. This problem could have been overcome by testing the cows once they had been settled at housing after a couple of days.

The other challenge was being able to select cows from each farm that were going to calve as close together as possible so that the blood samples were taken as close to one month before and one month after calving as possible. Cows were selected based on when they calved in the last calving period and pregnancy diagnosis results, as some scanners were able to provide information on how far on in-calf the cows were when scanned.

Some of the farmers did not have complete records on calf losses in previous years and so it was difficult to tell where calf losses were occurring (whether this was between scanning and birth or after birth to weaning). This has hopefully focussed the farmers' minds to keep more accurate records to help identify where losses are occurring from which they can hopefully take some sort of action to try and reduce calf losses.

Body condition scoring was carried out on the 15 trial cows on each farm both pre- and post-calving. Ideally it should have been the same vet that carried out the scoring, as it is subject to discrepancy between scorers. However due to COVID restrictions and changes to the vet's availability and work procedures, it was not always possible for the same vet to carry out the two body condition scores. This did lead to discussion with some farmers expressing their doubt about the accuracy of the scores. It is a subjective procedure, different people may score cows slightly differently, but it was a good discussion point none the less to focus on how much condition the cows may have potentially lost over the calving period, especially when the greater the loss the greater potential for fertility to be negatively affected.

Six of the farmers also weighed their cows pre- and post-calving. It was hoped that the difference in weight between the two recordings would tie up with the change in body condition score over the same period. However, when taking into account the weight loss after calving from the calf, placenta and fluids, there did not appear to be any correlation with BCS change. For example, one unit of body condition score is equivalent to 13% of body weight. i.e., a 700kg cow would need to lose 91kg of weight to go from a condition score of three to two. However, from the weight data, cows that had lost one condition score unit generally had not lost this amount of weight (nor the weight of the calf/placental/fluids which could account for at least 70kg). As many factors can affect body weight of cows, (such as digestive tract contents and when the cows were weighed in relation to feeding time etc), this was not thought to be a useful measure to assess nutrition, link it to BCS loss or how likely the cow was to get back in calf.

One of the downsides of the project is that to complete the picture of whether nutritional status (and body condition loss) over the calving period affects fertility, the calving dates in 2021 would need to be assessed to see whether cows in poorer nutritional status at calving time too longer to get back in calf. Unfortunately, this was just a 14-month project and so time and funds are not available to investigate this aspect of herd fertility. Nevertheless, SAC Consulting will continue to keep in contact with the project farmers and look at calving dates provided in 2021 to investigate this and report back to the farmers. This will be useful information related to this project that can be discussed at future on-line/on-farm events.

7.2 Impacts

An initial survey was conducted with the participating farmers, once the 2020 calving period and data on MP tests and nutrition had been reported on, in order to gauge the benefits of their involvement in the project. Some results of the survey are as follows:

50% of farmers made changes to nutrition based on MP tests pre-calving. Changes included:

- Increasing magnesium supplementation.
- Increasing mineral supplementation.
- Raising the protein content of the ration.
- Decision made to install new feed troughs for next winter to improve feed intakes.
- Decision made to review nutrition in closer detail at the beginning of next winter so that cows are more likely to be at the target body condition score for calving.

60% of farmers made changes to nutrition based on the MP test results post-calving. Changes included:

- Started feeding concentrates post-calving to help recover body condition lost over the calving period.
- Increased level of concentrate feeding to combat poor energy results.
- Increase magnesium supplementation to reduce the risk of grass staggers.
- Altered mineral supplementation to improve phosphorus level to help aid fertility.

- Closer observation/preferential treatment for cows showing health issues/poor energy status.

Some farmers did not make any changes to nutrition based on the results of the MP tests. This was due to the results being satisfactory and not highlighting anything specific that needed rectifying.

When farmers were asked what they might implement in the future to improve nutrition around calving time, responses were:

- "*Potentially take more advice."*
- *"Split cows that have calved from cows still to calve and feed accordingly."*
- *"Try to improve silage quality and change feed trough."*
- *Try to make better silage, condition score possibly, metabolic profile test again."*
- *"Try to make better silage, historically low in protein."*
- *"Condition score two months before calving and regroup according to condition."*
- *"Magnesium bolus instead of phosphorus/copper and increase silage intake pre-calving."*
- *"Do blood tests on cows mid-winter to ensure they are on track for calving."*
- *"Test silage closer to calving to ensure enough protein."*

Positive responses that showed farmers got something useful out of the MP tests and being part of the project – the majority of them found something they could alter to help improve future calving performance and herd fertility.

The farmers were engaged with the whole project, were keen to discuss their results and get feedback on what they could do to improve further. This is supported by the fact that every farmer attended the on-line meeting in January 2021 to discuss the fertility results from all the farms. After that event, a survey was carried out to find out what farmers took away from the project and the event and some of the feedback to two of the questions posed were:

What was the most important thing you took away from the webinar and your herd's fertility results?

- To record and analyse more data from the herd.
- There is always room for improvement and ways to make that happen. From a mental health point of view everyone has losses and being part of a group of highly capable farmers shows just how difficult it is to get over 94% calves weaned.
- Importance of magnesium pre-calving and making sure cows get enough dry matter intake.
- Calving pattern is good but has room for improvement and to continue blood testing cows metabolic profile status pre-calving.
- That the group is all striving for more weaned calves and discussions between SAC Consulting and vets and the group about little tweaks about our own herds problems can bring positive changes.
- I need to hit more targets for calves weaned and calves born alive.
- Encouraged by hearing of other farmers' experiences.

Further comments/feedback on webinar content (or any aspect of project) welcomed.

- Very happy to have taken part in the project.
- Enjoyed the meeting and taking part in the project. Hopefully some kind of meeting in person could take place in the future discussing any change we have made. I think we as farmers would open up and have more chat compared to an on-line meeting.
- Worthwhile project. Happy to contribute calving details for 2021 plus other information for follow up analysis.

Further impact from the outputs of this project will be made through dissemination of the information at future events and use of technical notes by our team of consultants to advise clients on herd management. It is also expected that the podcast will have a wide reach, which was made available on the Farm Advisory Service website on 1st March 2021.

Some of the farmers expressed interest in continuing with MP testing in preparation for 2021 calving due to the benefits they found with it through this project. Many farmers have also taken more nutritional advice and made a more conscious effort to manage cows more appropriately at the beginning of the 2020 winter by paying closer attention to body condition score and winter feeding to better achieve the target condition score for calving. The feedback from the farmers involved was also extremely positive and SAC Consulting will continue to work with these farmers over the 2021 calving period to further analyse calving data and provide advice.

8. COMMUNICATION & ENGAGEMENT

8.1 Detail throughout the project's lifetime

Farm Visits

All farmers received a visit from their vet both pre- and post-calving to blood sample and condition score cows. SAC Consultants also carried out farm visits pre-calving to collect ration information and discuss the farms' nutritional management over the calving period. This was carried out in early 2020 before lockdown restrictions were imposed. Farms were visited when it was possible to do so throughout the year, depending on the farmer requirements for advice (COVID-19 rules depending).

Farm visits were also carried out in the autumn/early winter where possible to gather fertility data. When on-farm visits proved difficult, phone calls and email were used to communicate with farmers to collect information and discuss results.

Data Collection and Analysis

There was a significant amount of data collected throughout the project which can be broken down into the following areas:

Nutrition at calving time.

This included ration details pre- and post-calving along with silage analysis and details of mineral supplementation (specification of product fed and intake). Some farmers also administered trace element boluses and this information was also taken into account to assess trace element supply in relation to animal requirements. BCS and cow weights were also collected and analysed in relation to nutrition and performance over the calving period.

MP Data

Blood tests from 15 cows in each herd were carried out both pre- and post-calving. The following parameters were tested for, which provided information on protein, energy, health and mineral status:

- Energy status: non-esterified fatty acids, beta-hydroxybutyrate and glucose
- Protein status: urea, albumin and globulin
- Mineral status: magnesium phosphorus, copper, selenium and iodine

At the same time, cows were given a body condition score by the vet and weighed if there were facilities to do so.

2020 Pregnancy Diagnosis (scanning)
The following information was gained from all the herds when all breeding animals were ultrasound scanned for pregnancy diagnosis:

- Number of cows/heifers scanned
- Number of cows/heifers in calf
- Number of cows/heifers not in calf
- Number of sets of twins
- How many days in calf for each animal (if provided by the scanner)
- Confirmation on whether all 15 trial cows were back in calf

Historic fertility information including:
Pregnancy diagnosis data was also collected for the 2017, 2018 and 2019 scanning years, as well as the number of calves born alive and number of calves weaned. Calving dates for the whole herd were also collected in 2019 and 2020 to calculate the herd's calving interval, as well as the percentage of cows calving within the first 3, 6 and 9 weeks of the calving period (important KPI's for the suckler herd) so these could be compared to industry targets.

<u>On-Line Events</u>
Three on-line events were held throughout the project, the first two were purely for the participating farmers in the project and took the format of virtual meetings where the results of MP testing and fertility data were benchmarked and discussed.

The 3rd event was a webinar open to all farmers, vets, advisors and others working in the beef industry to discuss the aims of the project and its findings (by Karen Stewart of SAC Consulting). This was followed by a detailed talk by Alastair Macrae from the University of Edinburgh's Royal (Dick) School of Veterinary Studies on the benefits of MP testing in the suckler herd and how that information can be used to optimise nutrition and fertility. There was also a focus on the main reasons for calf losses between scanning and birth and what can be done to avoid them. The advert for this event, detailing the speakers and topics covered is shown in Annex 3. This event had 93 people signed up for the event and 47 people attended the webinar on the night.

A feedback survey was sent out to attendees of the webinar and a summary of the results are as follows:

- 100% of respondents rated the meet as "excellent" out of "poor", "fair", "good" or "excellent" and they all said they found the topics engaging.
- 75% of respondents said they would implement changes to their management practices on the back of what they heard in the webinar.
- The areas they would look at making changes to included more regular body condition scoring, adjusting the bulling period for cows based on the calving spread and nutrition.
- 75% of respondents said they were happy with herd fertility but felt there were things that could be done to improve it further. Whereas 25% said they were not happy with herd fertility but there were things that could be altered to improve that, highlighting the continued need for consultancy advice based on research outcomes (and this project) to help farmers improve herd performance.
- The key areas identified that farmers wanted to improve were tightening up the calving interval and reducing barren cows.

<u>Press and Articles</u>
Three technical notes have been produced and are based on three important aspects of the project:
1. Metabolic Profiling in the Suckler Herd

2. Management of Nutrition around Calving in the Suckler Herd
3. Management of Replacement Heifers into the Suckler Herd

These are available on the SAC Consulting and FAS website and will be of benefit to our consultants when advising clients. They will also be circulated round SRUC's Education Division for use in student learning.

An article detailing the project and its findings will be published in Scottish Farmer in late March and the April edition of Farm North East. A press release was also issued to media on 25th February and can be accessed here:

https://www.sruc.ac.uk/news/article/2816/study_highlights_feeding_for_fertility

The project has also been referenced in SAC Consulting's monthly publication Beef and Sheep News which is a subscription only publication. Article title: Magnesium for the Autumn Calving Herd in August 2020 edition.

Podcast

A podcast was produced with one of the participating farmers and his vet (who's suckler herd was also one of the herds taking part in the project). The podcast discussed Andrew Houston's management of the Aberdeen Angus Glenkilrie herd, focusing on improving fertility and managing heifers efficiently to calve at two years of age. The farmer also mentioned the benefits he got out of the project, which was reassurance from the MP tests that nutrition was adequate. He also benefited from a visit by SAC Consultant Lorna MacPherson to discuss cow condition, on the back of which ration changes were made to avoid cows getting too fat for calving, whilst also saving money on expensive bought-in feed. His vet discussed the benefits of MP testing in the suckler herd and some of the key things to focus on to improve herd fertility.

The podcast was made available on Spotify, Good Podcast, Apple, The Farm Advisory Service website and SRUC/SAC Consulting social media pages. It can be accessed here:

https://www.fas.scot/publication/feeding-for-fertility/

8.2 FAS Engagement (if applicable)

A project report will be made available shortly on the FAS website so that the findings from the project are available to all beef farmers and industry representatives. The project findings will continue to be disseminated through relevant farmer meetings including FAS events in 2021 and beyond.

8.3 EIP-AGRI Engagement (if applicable)

The final project summary will be posted on the EIP-Agri site.

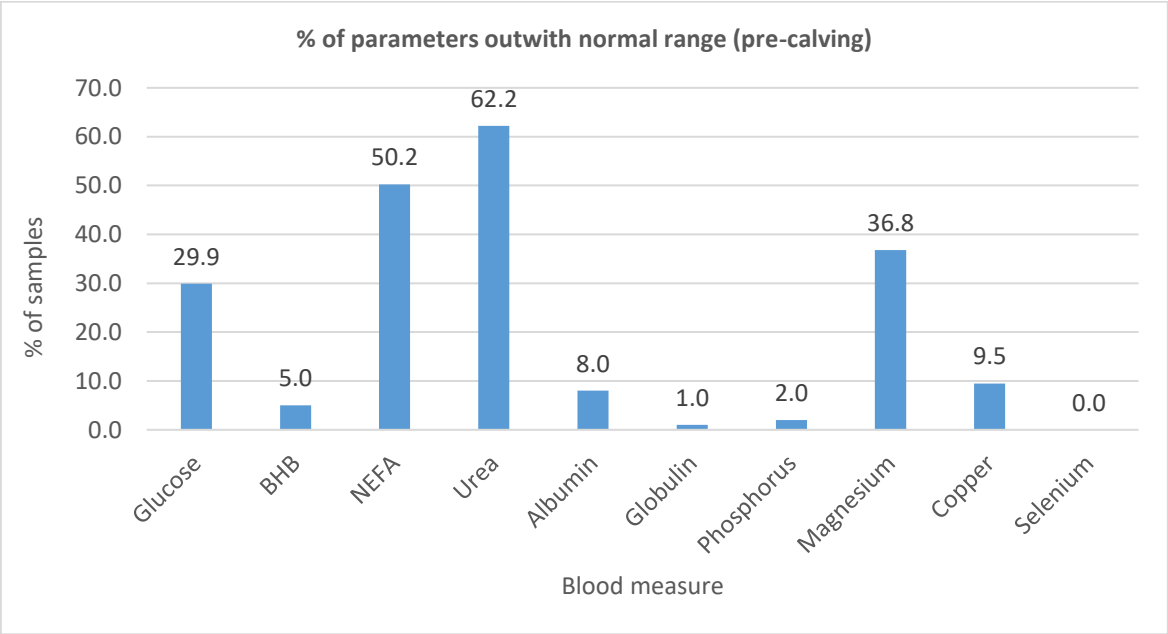
9. KEY FINDINGS & RECOMMENDATIONS

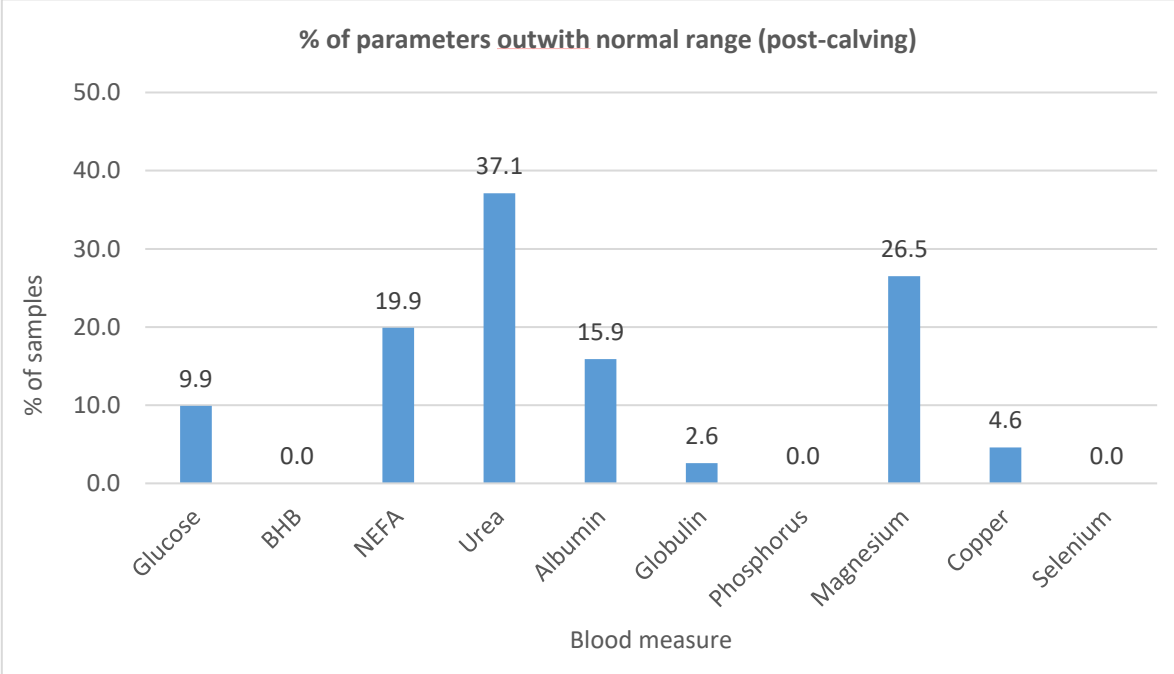
Findings

Key findings from MP tests and nutritional assessment:

- One third of cows were deficient in magnesium pre-calving (see graph below which indicates the % of cows sampled that had blood parameters out with the target range). This is significant given the impact a lack of magnesium can have on slow calvings and then potentially the health status of the calf (how quickly it stands and suckles colostrum).

- One quarter of cows were deficient in magnesium post-calving (see graph below). Again, this is significant to address, with low magnesium in cows going out to grass exacerbating the risk of grass staggers.
- The other parameters that were often out with target levels both pre- and post-calving in the blood were urea (indicating protein deficiency) and poor energy status (lack of energy in the diet and loss of condition). This could result in low colostrum quality and quantity if not corrected.
- From reviewing mineral supplementation, many herds were oversupplying minerals (it was extremely rare for any cows to be deficient in the minerals tested for other than magnesium, which is highlighted in the graphs below).
- Industry targets for herd fertility are very high and difficult to achieve consistently, even by this group of highly capable and successful farmers.





MP testing in suckler herds is fairly novel and very few herds will do this as routine practice in the pre-calving period, unlike dairy herds. However, the farmers all found it very useful information with at least three keen to repeat this at their own cost for the 2021 calving period. It is a great way to "ask the cows" what they think of their ration and can highlight areas of nutrition where corrections can be made to benefit calving performance, energy status and subsequent fertility.

While on paper the rations may have appeared to meet requirements, the MP tests give the real picture of how the cows are coping and could therefore point to management factors that might be leading to suboptimal nutritional status (e.g., insufficient feed space, health/fluke issues and ration presentation).

While there were instances where the MP results looked poor, with cows in poor energy status and had lost significant condition, as farmers acted on the results to increase energy supply via concentrate feeding or access to good grass in preparation for bulling, a high percentage of trial cows got back in calf. Therefore, the MP tests did not necessarily give a good indicator of future fertility and the likelihood of cows getting back in calf. However, their benefit is that corrective action can be taken that will help improve the number of cows getting back in calf.

When analysing pregnancy diagnosis information and historic herd fertility data it became apparent that the industry targets for herd fertility are very difficult to achieve consistently year on year. However, it is important farmers do not get disheartened by not achieving industry targets every year. Instead, what they took from this aspect of the project is that some of them need to record and analyse data more thoroughly to identify where improvements can be made and with expert advice, make management practice changes that could improve fertility and reduce calf losses.

<u>Recommendations</u>

There are many recommendations to farmers that came out of the project and these varied from farm to farm depending on their system of management, nutrition, type of cow, fertility management, bull management etc. Some of these recommendations were nutritional related on the back of the MP test results and others were related to improving herd fertility and reducing calf losses with the ultimate aim of increasing the percentage of calves weaned in the herd.

- Ensure pre-calving mineral supplementation is adequate, particularly to meet magnesium requirements (one third of cows tested pre-calving were low in magnesium). This is important to avoid the risk of slow-calvings and milk fever related issues.
- MP testing is worth doing in the future to highlight nutritional issues in the cows that could affect calving performance, milk production and fertility. It can also be used to pick up health issues (in two of the herds liver fluke was identified on the back of the MP test and prompt treatment helped ensure that cows did not unduly suffer from the negative effects of fluke and protected herd fertility.
- Feeding of concentrates post-calving on the back of poor energy status in the post-calving MP test, as well as body condition score loss is important. This benefited cow condition before being served by the bull, as well as being a way to get more magnesium into cows (a quarter of cows' MP tested post-calving were low in magnesium).
- Body condition score cows early on in the winter so that there is sufficient time to adjust condition to achieve the target condition score for calving. Split cows according to condition and whether any are carrying twins (they have the same energy requirements as heifers which are still growing). This will help minimise calving problems with overfit cows, as well as save money on cheaper rations.

- Test forage quality early in the winter so that rations can be tailored to requirements. Retest forage quality closer to calving.
- Record all calf losses – even if they occur before birth (i.e., abortions, still births etc) to build up a picture of where issues are occurring and possible reasons. This makes it easier to identify where the biggest gains can be made through changes to management to increase the percentage of calves weaned, the key driver of profitability in the herd.

10. CONCLUSION

To summarise, this has been a highly successful project in that what was set out in the application was achieved. The participating farmers were also very engaged with the project throughout the year. Feedback surveys from them indicated that they found the MP testing, nutritional advice, fertility review and recommendations very helpful and has helped to focus their attention on several aspects of herd management, such as body condition scoring, nutrition over the winter period for good calving performance and the importance of keeping and reviewing fertility and calving records.

One of the novel aspects of the project was MP testing in suckler cows post-calving. This is rarely carried out pre-calving in suckler herds (and very common in dairy herd management) and had not been done before in suckler herds post-calving in Scotland. While this project was never going to significantly alter current nutritional recommendations for managing suckler cows at calving time on the back of the results, the MP testing has helped highlight what the key nutritional problems tend to be over the calving period and what farmers need to focus on. The results also enabled farmers to make changes to nutrition to improve the nutritional status of the herd, which hopefully in turn helped to protect fertility and result in less barren cows. This was a key outcome in that MP tests can be used successfully in the suckler herd to help manage nutrition and improve the outcome for calving and efficient herd fertility. It is also another way to assess health status as liver fluke was detected in two herds, which might have taken longer to diagnose without the MP tests, resulting in poorer health status that could have adversely affected fertility.

It is well recognised and accepted that industry targets for suckler herd performance are challenging and difficult to meet consistently year on year. Even the top 25% of QMS costed suckler herds struggle to meet the 94% target of calves weaned per 100 cows put to the bull, often due to calf deaths which can be hard to control. However, this project focused on several aspects that will help farmers get closer to industry targets and will help improve overall profitability and long-term sustainability of these businesses in the future.

There have been many project outputs that will highlight to industry the importance of nutrition over the calving period and how MP testing can be used to monitor nutrition and aid fertility. These outputs include a webinar, podcast and three technical notes, all of which will be made available on the SAC Consulting and Farm Advisory Service webpages. In addition, several published articles in local and national press have highlighted the project and the key messages.

Another positive note is that some of the project farmers are going to carry out MP tests this year pre-calving at their own expense, proving this has been a very valuable herd management tool. In addition, both Karen Stewart and Lorna MacPherson of SAC Consulting will continue to work with all project farmers in spring 2021 to collect calving data information so that further analyses can be carried out to provide further feedback on the project. This will be valuable data that can be presented at future farmer meetings, resulting in continued knowledge exchange to the industry beyond the time and funding scope of this project.

Annex 1. Example Pre-Calving Report

Pre-Calving Report for Farm A.

Pre-Calving Nutrition

- Pre-calving nutrition has altered a few times since first discussing this project.
- On first visit (3.12.20), cows were thought to be overconditioned and so recommendations were made to reduce energy intake. Ration changes and dates are detailed below:

Feed	Diet housing until 4.12.19	Diet from 4.12.19 until 15.1.20	Diet 15.1.20 until 12.2.20
Grass silage bales	30kg	-	Ad lib (~22kg)
Rye wholecrop	15kg	14kg	14kg
Barley straw	-	2kg	2kg
Oat straw	-	7.6kg	-
Barley	1kg (previous week 1.5kg)	1kg	1kg
Minerals	0.1kg	0.1kg (pre-calver)	0.1kg (pre-calver)
Intake (kg DM)	12.1	13.6	11.8
ME supply (MJ)	122 (target 84 -10 wks pre-calving)	110 (target 103 - 4 wks pre-calving)	113 (target 103 - 4 wks pre-calving)
Crude Protein (% DM)	9.5 (target 9)	5.7 (target 9)	8.6 (target 9)

- Cows were bolused with 2 CoseIcure high Iodine boluses on 20.1.20 and 21.1.20.
- Cows were blood tested on 28.1.20, approximately 4 weeks before calving. Start of calving estimated to be 21.2.20 for pen 4 and 24.2.20 for pen 7.
- Assume ration will change from 12.2.20 onwards to remove baled silage (as mouldy) and increase rye wholecrop along with a protein source to ensure adequate protein level in ration (either urea, pot ale or soya).

Comments

- Intakes have varied slightly with the different rations. I would be surprised if cows were eating the full amount of oat straw calculated, as the dry matter intake was a good bit higher than predicted.
- Certainly, the initial diet was excessive for energy intake for the stage of pregnancy and the ration from 15.1.20 was much more appropriate for energy intake. While protein was a little low (below the 9% target), it was significantly better than the ration with oat straw.
- A 700kg suckler cow 3 weeks before calving requires about 106MJ so while the current ration on paper seems a little high, given that some cows had poor energy status from the blood results, I would not be too concerned about this.
- Body condition of cows when blood tested were well above the 2.5-3 target for spring calving cows. However, I do think they had dropped a little condition from my first visit in December. It will be interesting to hear how calving goes and whether there are any issues with calving in cows that were scored over 4.

Mineral Supply and Requirements
Assuming standard background levels of minerals in wholecrop, silage, straw and barley in the Feedbyte ration programme and including 100g of the Almins Pre-Calver mineral, mineral supply versus requirements are shown in the table below, based on the current diet with baled silage. This is based on requirements for a 700kg beef cow 4 weeks from calving. There were no deficiencies of major minerals, trace elements or vitamins.

Mineral	Units	Feedbyte Requirement	Diet Supply
Calcium	g	42	64
Phos	g	28	33
Mag	g	17	24
Sodium	g	7	25
Copper	mg	174	253
Manganese	mg	454	1125
Zinc	mg	454	773
Iodine	mg	5.7	78
Selenium	mg	1.4	4
Cobalt	mg	2.3	9.8
Vit A	iu x 1000	45	137
Vit D	iu x 1000	8.5	10
Vit E	iu	250	677

- According to Feedbyte, requirements are easily met for all major minerals, trace elements and vitamins.
- Iodine supply greatly exceeds requirement, especially with the high iodine level (750mg/kg) in the pre-calver mineral (78mg supplied versus 5.7mg requirement) and before bolusing.

Bolus Supply

CoseIcure high iodine boluses (2) are administered at least 4 weeks before calving starts. These provide the following levels of trace elements (assuming they release their contents at the same rate over 180 days).

13.4% w/w copper = 13.4g per bolus x2 = 26.8g/180d = 149mg/day
0.15% w/w selenium = 0.15g per bolus x 2 = 0.3g/180 days = 1.67mg/day
0.5% w/w cobalt = 0.5g/bolus x 2 = 1g/180days = 5.56mg/day
1% w/w iodine = 1g/bolus x 2 = 2g/180 = 11.1mg/day

Total trace element supply from the diet and including boluses versus requirement for certain trace elements is high (with 100g Almins Suckler Pre-Calver mineral):

Trace element	Total Supply	Feedbyte Requirement
Copper mg	402	174
Cobalt mg	15.4	2.3
Selenium mg	5.67	1.4
Iodine mg	89.1	5.7

Note the above total supply is based on average forage values of trace elements.

Pre-Calving Blood Test

Key points:

- Protein status was poor with all cows tested having blood urea below the target range of 1.7-5mmol/litre, indicating insufficient rumen degradable protein. Whilst the diet was slightly on the low side for protein, it was significantly better than the ration with oat straw. Steps will be taken to increase protein level in ration as of 12.2.20. If cows had little access to feed before blood samples were taken, this could have also influenced the results.
- Energy results were a little mixed. However, there were only 4 cows from pen 1 and 1 cow from pen 2 with NEFA's (non-esterified fatty acids) above target levels. This would tend to indicate body fat mobilisation and negative energy balance. This could reflect the fact that nutrition had been altered to try and slim cows down (and question the intakes of oat straw and whether cows were actually low on energy intake with this ration). The low protein would also have affected rumen function and feed conversion). Based on the ration change from mid-January and the small number of cows with high butyrate values (only 3 out of 30), overall energy status in the herd is not much of a concern, especially when dietary protein levels are to be improved.
- 11 out of 30 cows were low in blood glucose. This could be due to issues with energy supply from the rumen (again to be improved with protein level being increased with the diet change to remove baled silage). It could also be due to low feed intake prior to blood sampling.
- Some cows were struggling with low magnesium levels with 5 out of 15 cows below the 0.8mmol/litre target. Again, this could be influenced by low feed intake prior to sampling. Increasing mineral to 125g should help maintain magnesium levels without the grass silage. If slow calvings look to be an issue (or milk fever), I would suggest increasing mineral supplementation further to 150g to increase magnesium supply.
- Iodine levels in the blood from the pooled sample were more than adequate at over 150µg/litre, and well above the reference range of 50-105 µg/litre (and this is before bolusing).

Discussion Points for Future

Are the boluses necessary? Certainly, there is a huge oversupply of iodine and cobalt, and copper and selenium levels are also more than adequate before bolusing. Note selenium levels in blood were all above the target of over 50 (before cows were bolused) and copper fell into the normal range (however, only when cows are severely deficient in copper will this be reflected in low blood levels).

It may be worth getting some forages tested for minerals in the future to look at trace elements and levels of antagonists (iron, aluminium, sulphur, molybdenum), which can reduce trace element absorption in the gut). If these were high, it would perhaps justify bolusing (but not for iodine). If not, are the boluses necessary and have they shown a benefit in the past on fertility/calving interval/calf health?

There were no cows body condition scored below 3.5. It would be worth at the beginning of housing this year for condition to be assessed and rations formulated to take into account condition i.e., if weight loss needs to be factored in with the aim of getting cows closer to the target condition score 1 month before calving.

Annex 2. Example Herd Fertility Report

Farm B Fertility and Benchmarking Report

Fertility History

The following table details fertility data from the herd over the last four scanning years. Note the year at the top of the table is the year the cows were scanned so the calves born and weaned etc in that column will be in the following year. The performance figures highlighted in blue are three key benchmarks to look at.

Scanning year	2017	2018	2019	2020	Target
Cows/heifers PD'd	177	176	175	181	
Cows/heifers in calf	162*	148	162	176	
No. sets of twins	3	1	2	4	
No. calves in theory	165	149	164	180	
No. live calves born	165	147	158		
Calves born alive/100 put to bull (%)	93.2	83.5	90.3		>95%
No. calves weaned	163	143	154		
No. calves lost between scanning and birth (and %)	0	2 (1.3%)	6** (3.7%)		<3%
No. calf losses birth to weaning (and %)	2 (1.2%)	4 (2.7%)	4 (2.4%)		<3%
No. calves lost between scanning and weaning	2	6	10		
% cows in calf	91.5	84.1	92.6	97.2	>95%
% barren cows	8.5	15.9	7.4	2.8	<5%
% calves weaned/100 cows put to bull	92.1	81.3	88.0		>94%

*162 in calf is a guess based on number of twins and calves born (scanning sheet was lost). There could have been more cows in calf at scanning but then there would have been more calf losses from scanning until birth.
**4 calves recorded on calving sheets were born dead and 1 died shortly after birth once tubed. Two must have also been lost between scanning and birth.

The 2020 scanning year was the best in terms of barren cows, which was significantly lower than the previous three years scanning results. Based on nutritional status of the cows over the 2020 pre-calving period, this is not surprising, given that all 15 cows blood sampled post-calving had a perfect set of energy results (and very few results pre-calving that were of any concern for poor energy status). Cows were fed 2kg concentrate post-calving (2kg Harbro Beef Nuts and then onto ECV Suckler Booster Rolls. While 10 out of the 15 cows lost 1 BCS unit or more between the pre- and post-calving blood sample, the concentrate feed post-calving will have helped maintain condition and get cows cycling quicker after calving. It was also a very good year for grass over the bulling period which may have helped.

The target of 94% calves weaned per 100 cows put to the bull is very difficult to consistently achieve, although the herd was close to this target in the 2017/18 year at 92%. Given the low barren rate at the 2020 scanning, the herd is off to an excellent start to try and achieve a high calf output this year.

Looking at calf losses, there was little difference as to whether losses occurred between scanning and birth (8) or after birth until weaning (10), and the percentages of calves lost in relation to the number of calves scanned, were generally in line with the target of <3%.

There are several areas where calf losses can occur but cows not in calf appears to be the biggest “loss” in the herd. Either these cows did not conceive, or they conceived but lost the pregnancy before scanning. On the cow side, the main factors influencing barren rates are:

- Cow condition at calving and mating. Also, condition loss over the calving period and this appeared to be quite substantial in 4 of the trial cows losing 1.5 condition score units (although they are all back in calf).
- Nutrition and trace element status (although not a concern as indicated by the blood results for energy and minerals and a quality mineral supplement being fed over the calving period).
- It is recommended that first and seconds calvers should be given preferential treatment/feeding both pre- and post-calving (especially if calved as 2-year-olds).
- Health/vaccination status.
- Heifer management – is the mating period for heifers also 12 weeks? A restricted heifer mating period (6 weeks) will lead to compact calving as cows. Ensure heifers are a minimum 65% of mature body weight when bulled.

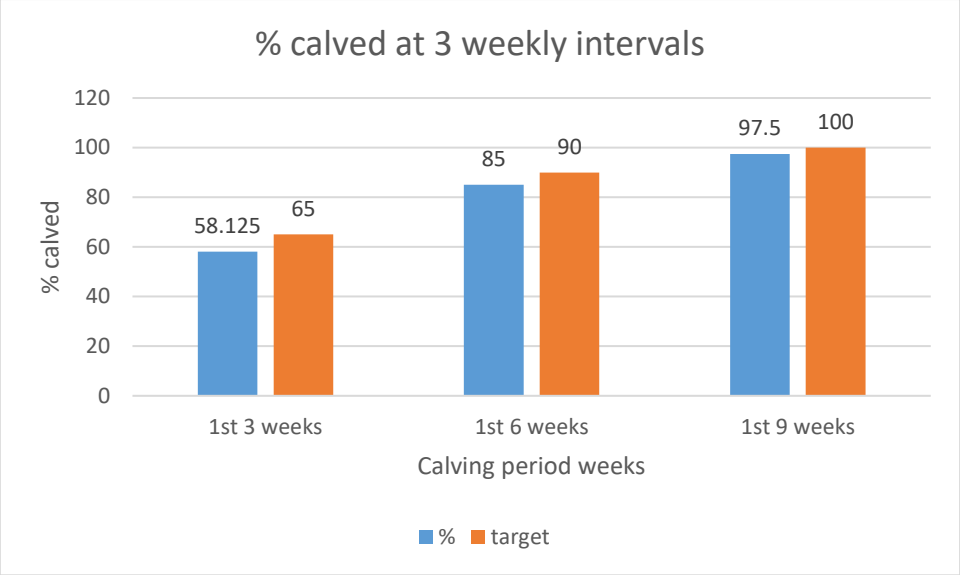
It may be useful to assess the records of barren cows for age (older cows, or younger cows struggling to grow, rear a calf and maintain body condition), whether assistance was required at their last calving, where they calved in the last calving period (late-calved cows have less chance to recover and hold to the bull at mating) and approximate condition score at their last calving. This might help identify reasons for barren animals and aid culling decisions going forward.

Calving Interval (2019-2020)

There was a calving date for 114 cows which had calved the previous year. The calving interval for these cows was 366 days, with a wide range of 315-425 days. The trial cows calving interval was 352 days with a range of 322 to 380 days. The target is 365 days and ideally over 90% of the herd should have a calving interval less than 370 days. 66 out of 114 cows had a calving interval less than 370 days = 57.9%.

Calving Spread 2020

Cows were due to start calving on the 15th of March (based on the bull going out on the same date each year and when the first calf appeared last year). Bulls went in with the cows in 2019 on 9th June + 280-day gestation = 15th of March). From the cows that calved in 2020, the spread of calving was calculated from the 15th of March, working out the % calved in the first 3 weeks, first 6 weeks and first 9 weeks as shown in the following graph. Any cows that calved before the 15th of March were included in the first 3 weeks.



Do the heifers get the same length of time with the bull? It might be worth looking at the calving spread of the heifers (and length of time bulls were in if longer than 6 weeks). Was this as tight as you would have liked it?

The percentage of cows calved within the first 3, 6 and 9 weeks fairly close to the targets so it is perhaps difficult to see how this could be tightening up further. Some ideas to help include:

- Heifers/lean animals/those with twins/caesareans/difficult calvings – group together and continue to feed concentrate throughout the bulling period (level dependent on grass availability).
- Pre-bulling vet check for herd or at least priority animals mentioned in point above.

The percentage of cows calved in the first 3 weeks reflects overall fertility efficiency of cows and bulls and the greater the percentage of calves born here will result in a higher average weaning weight, helping boost herd output.

2020 Scanning Results

Two of the trial cows were culled due to bad temperament and a bad udder. The remaining 13 out of 15 trial cows are all in calf and range from 130 to 160 days in calf when scanned on 30th November. Out of the 146 cows scanned, only 1 was not in calf and out of the 35 heifers scanned, 4 were not in calf.

All trial cows had perfect blood energy results post-calving (and very few energy concerns from the blood results pre-calving). However, six out of the 15 cows lost 1 BCS unit from the pre-calving blood sample to the post-calving blood sample and 4 cows lost 1.5 units. This has not prevented these cows getting back in calf, but it will be interesting to see when these cows calve in 2021, and if their calving interval has been extended.

Going by the scanning results, 2 out of the 4 cows that lost 1.5 units, were the latest in calf and also appeared to have a slightly longer predicted calving interval due to them calving earlier than most of the trial group (cows 475 and 487). Based on the days in calf estimated by the scanner, the date the cows conceived, the interval from calving to conception and estimated calving date in 2021 was calculated based on a 285-day gestation:

Cow no.	Calving date 2020	Days in calf on 30.11.20	Calving to conception (days)	Estimated calving date 2021	Expected calving interval (days)	BCS loss at 2020 calving
460	31 Mar	160	84	4 Apr	369	1
471	5 Apr	160	79	4 Apr	364	1
354	10 Apr	150	84	14 Apr	369	1
373	20 Mar	160	95	4 Apr	380	1
424	14 Apr	150	80	14 Apr	365	1
438	10 Apr	150	84	14 Apr	369	1
473	26 Apr	130	88	4 May	373	1.5
421	5 Apr	150	89	14 Apr	374	1.5
475	1 Apr	140	103	24 Apr	388	1.5
487	4 Apr	130	110	4 May	395	1.5

The average calving to conception interval for the trial cows was estimated at 90 days (range 70-110 days) and for the whole herd 84 days (range 36-119 days). The average calving interval (based on the predicted calving date in 2021) was estimated at 375 days for the trial cows and 369 days for the whole herd, which is slightly longer than the 2019-2020 calving interval (352 days for the trial cows and 366 days for the whole herd).

Recommendations

It is difficult to provide recommendations to help improve herd fertility (and this year's scanning results were excellent!) given my limited knowledge of the herd. Going by previous years data, achieving a low barren rate and improving the percentage of calves weaned should be the focus. Calf losses were fairly evenly spread during gestation and from after birth to weaning, with a wide range of factors affecting calf losses (and I am not sure the reasons for the calf losses after birth).

Perhaps it is worth an assessment of later calving cows, cows which had problems at calving, age etc to help with culling decisions to help tighten up fertility in the future? Also are the bulls on the farm going through a thorough MOT each year? Hopefully, some of the suggestions in this report provide food for thought and further discussion with your vet to help improve herd fertility and calf output.

Annex 3. Advert for open webinar.

PREPARING FOR NEXT YEAR'S CALF CROP: MANAGING FERTILITY IN THE SUCKLER COW

SAC CONSULTING

Join us on **Thursday 11th February 2021 at 7.30pm** for a discussion on assessing nutritional status of suckler cows and its impact on herd fertility to maximise future calf output.

Speakers:

Karen Stewart, Ruminant Nutritionist, SAC Consulting

Karen will present the findings a recent Scottish Government funded project involving 12 beef farmers in Angus and Fife using metabolic profile testing to assess nutritional status of cows over the 2020 calving period. This will be discussed in relation to herd fertility with pregnancy diagnosis results for the 2021 calf crop.

Alastair Macrae FRCVS, Royal (Dick) School of Veterinary Studies, University of Edinburgh

Alastair runs the Dairy Herd Health and Productivity Service, and will discuss metabolic profile blood testing in beef cows to "ask the cows what they think of their diet", and how the results can then be used to tailor nutritional management to optimise calf health and cow fertility. Maximising the number of cows in calf and looking at key areas of calf losses before birth and how to avoid them will also be discussed.