MONITOR FARM Scotland

INNOVATION ON SCOTLAND'S MONITOR FARMS: BOOSTING PRODUCTIVITY, PROFITABILITY AND BUSINESS SUSTAINABILITY

The Monitor Farm Scotland initiative 2022-2026 is managed by Quality Meat Scotland with support from AHDB and funded by the Scottish Government Knowledge Transfer and Innovation Fund.

CONTENTS

FOREWORD – BETH ALEXANDER

PROGRAMME MANAGER, MONITOR FARM SCOTLAND

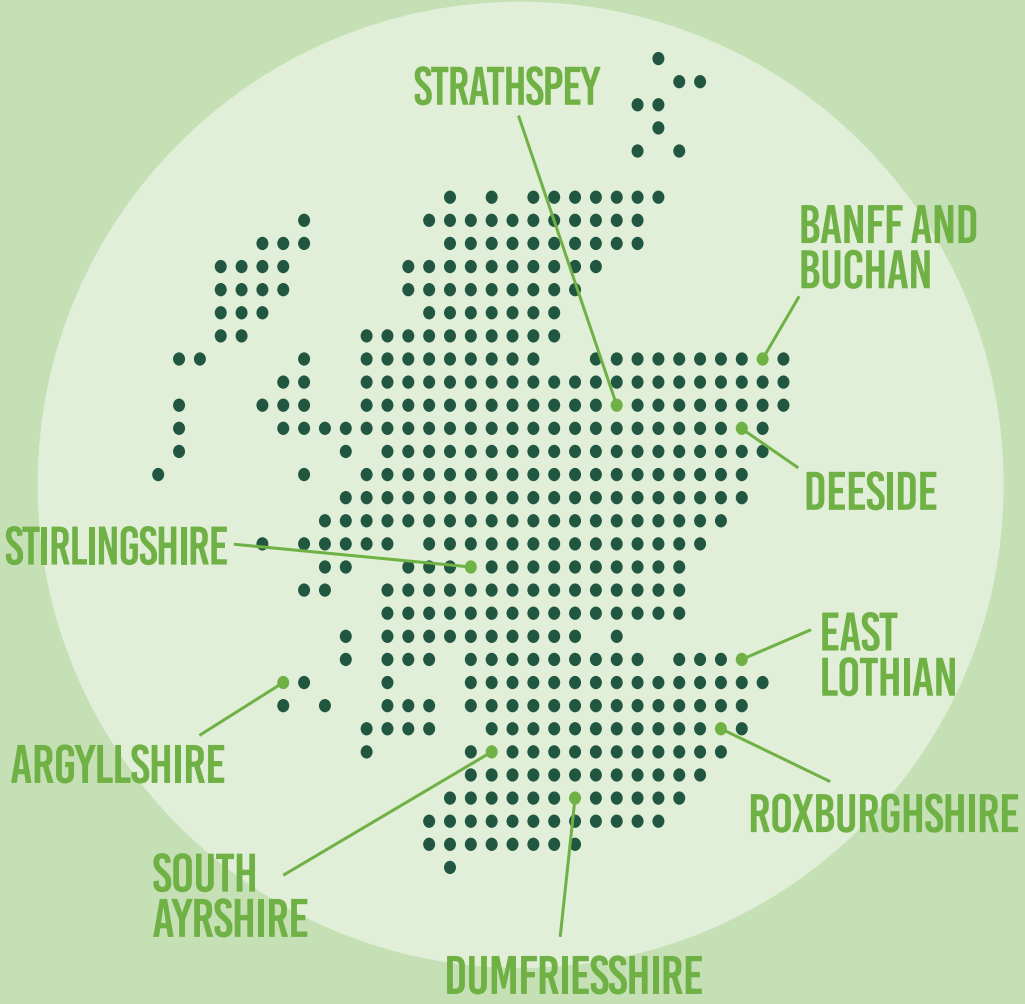
During its 21-year lifetime, the Monitor Farm initiative has pioneered new ways of working, experimented with new ideas and influenced change, and that is certainly the case for the current programme.

Launched in November 2022, it runs to 2026 and is the first programme to extend to four years. It is managed by Quality Meat Scotland (QMS), with support from AHDB, and is fully funded by £2 million secured from the Scottish Government's Knowledge Transfer and Innovation Fund.

Innovation is one of the programme's strengths, and this booklet outlines some of the research and approaches being trialled on the nine Monitor Farms. It covers work which has been successfully completed and projects which are ongoing. All are practical and aimed at improving productivity, profitability and business sustainability for the Monitor Farms involved and for the wider farming sector though our management and community groups, as well as press coverage and social media.

Implementing research and innovation can be challenging, and people are at the heart of adopting and driving forward these innovative approaches. Our focus as a programme which is 'Farmer Led, Farmer Driven' will continue to be on encouraging people to innovate and collaborate to achieve a sustainable, positive future for Scotland's farming industry.

MAP OF THE MONITOR FARMS



FOR MORE INFORMATION ON THE MONITOR FARMS, SEE P26 ▶

VIRTUAL FENCING: COST-BENEFIT ANALYSIS

The cost-benefit of virtual fencing technology – which could transform managing hill and upland suckler herds – is being extensively trialled in commercial field conditions on four Monitor Farms.

The innovative system uses a phone-based app to remotely set and manage flexible virtual 'fences' or boundaries using sound and pulses in GPS-equipped cattle collars to create grazing paddocks. It means cattle can be contained on unfenced hill land, for example, and that the location and activity of individual animals can be seen instantly. It could help retain cows in hill and upland environments as it tackles many of the issues facing herds.

However, while it's accepted that the system has the potential to improve livestock performance and management, it is not yet well quantified. The Monitor Farm project will include monitoring animal performance over the two-year lifetime of the project and checking it against herd benchmark values and the expectations and practical experiences of Monitor Farmers.

The four Monitor Farms involved have already highlighted opportunities for the environment, farm profitability, livestock welfare and well-being by using virtual fencing to manage their suckler cows as it should allow them to optimise grazing and improve herd management. The trial will look at the labour savings from the technology, as well as assessing the training and support needed to implement the system.

CRAIG ARCHIBALD'S VIEW OF THE TECHNOLOGY AT THE ARGYLLSHIRE MONITOR FARM:

Longer term, the technology might help us keep more cows and sell more calves.

The trial will use technology supplied by Norwegian virtual fencing specialist Monil.

The hope is that the system will enable precise grazing control without the need for physical fences, farmers can optimise pasture use, improve herd welfare and reduce labour demands while enhancing sustainability on-farm.

Overseeing the trial is independent consultant and livestock specialist Dr Tony Waterhouse. He says the goal is to see how the technology works out for the Monitor Farmers and how it helps them with the job of keeping cattle in Scotland's hills.

MONITOR FARMS AND THEIR VIRTUAL FENCING GOALS:

ARGYLLSHIRE MONITOR FARM – the Archibald family are trialling with 25 of the farm's 225 Aberdeen-Angus cows on hill land at Craigens Farm. Their goals are:

- Use hill ground which isn't currently grazed by cattle in summer and potentially the shoulders of winter to make more grazing available.
- Grazing hill will improve grass for sheep.
- Improve biodiversity of the hill which may lead into future farm support/management schemes.
- Keep herd in safe areas, i.e. away from bogs and ditches as well as any protected areas.

SOUTH AYRSHIRE MONITOR FARM – John and David Andrew are trialling on 25 of the farm's 150 breeding cattle at their Blair hill farm. Their goals are:

- Use underused area of hill ground in summer and potentially the shoulders of winter to make more grazing available.
- Ease of management when calving outside. Keep cows to one area.
- Keep bull tight when running with cows.
- Easier to locate cows or quickly see if there is an issue.
- Potential to graze neighbouring woodland – extra grazing is always needed.

STIRLINGSHIRE MONITOR FARM – the Duncan family, trialling with 25 native-bred hill cows at Lands of Drumhead and Inveruglas. Their key goals:

- Locate cows and calves more easily.
- Use to monitor cow movements to check all is well.
- Keep herd in safe areas. i.e. away from walking routes, deep cervices.
- Use current under-grazed areas to improve grass quality for sheep grazing.
- Run bull in a defined area with cows to catch more and reduce bulling time.
- Free up more time/labour to focus on production at Lands of Drumhead.
- Improve personal safety (not having to search for cows).

STRATHSPEY MONITOR FARM – the Smiths at Auchernack will be trialling the technology with 15 Shorthorn bulling heifers on a hill which requires targeted grazing for biodiversity and on 10 older cows which are not bulling and have calves at foot which are grazing by the river on species-rich grassland (an important Strathspey habitat that needs managed grazing) and they may put one collar on the bull with the heifers. Their goals are to:

- Locate heifers on the hill more easily.
- Keep the heifers closer to the bull, so he will potentially catch more and tighten the calving period.
- Target grazing across the hill to benefit species-rich grassland habitats.
- Give early alerts for animals that move away from the herd.
- Free up more in-bye grazing ground for 150 suckler cows.

DAVID ANDREW'S VIEW OF VIRTUAL FENCING AT THE SOUTH AYRSHIRE MONITOR FARM:

"Being able to locate the cattle easily via the collars and app will reduce fuel use for the farm bike, which usually has to go right around the hill to locate the herd."

SOLAR POWER: HARNESSING IT TO OVERCOME WATER SUPPLY ISSUES

If you could get water for livestock to other parts of your farm, could you change your grazing system and profitability?

Dumfriesshire Monitor Farmer Richard McCornick had attempted rotational grazing for two years at Barnbackle and had not been successful due to limitations in water supply. Before this project started, the farm's water supply was running dry and with changes in climate this problem may get worse. However, using a solar powered water pump to access water from the farm's pond would help solve this problem and allow Barnbackle to successfully rotational graze – but would it work in practice?

RICHARD'S VIEW:

The solar pump was a game changer in the dry summer of 2023. We wouldn't have had the water capacity to do rotational grazing otherwise. This spring it has worked really well as it has been so sunny, but it wasn't quite so good when it was so dull last year.

A solar-powered water pump from Ardo Water Solutions was set up on-farm in summer 2023, during the very dry spell. It is mounted on a recycled plastic pallet for ease of movement and the main body is available in either recycled plastic or a galvanised box.

SOLAR-POWERED WATER PUMP

- Powered by a 200-Watt solar panel
- Includes 115Ah leisure battery
- 20A controller to regulate charge to the battery
- Capable of pumping six gallons of water per minute
- Maximum pressure of 50PSI
- Includes a pressure vessel and gauge
- Integrated pressure/demand switch

It was installed next to the farm's pond, which is not directly accessible for livestock, but now allows multiple fields to be opened up to trough watering.

A Kiwitech drag trough was included in the project to help with rotational grazing. In dry spells, water can be pumped from the pond into a header tank which supplies existing troughs too; before this, IBC tanks of water were having to be manually brought up to the tank.

Besides the initial cost of the pump, there are few other costs. Richard says it has meant that Barnbackle has been able to rotationally graze without water shortage pressures and eliminate the need for manual labour to move water from the main source up to fields.

It has had a clear benefit to the farm; the main one being time saving.

COVER CROPS: FROM ESTABLISHMENT TO GRAZING

What impact do different cover crop establishment techniques and seed mixes have on soil health and crop productivity? This project on the East Lothian Monitor Farm includes nine plots using a variety of establishment methods, aiming to inform best practices. Discussion across the Monitor Farm Scotland network identified a challenge of establishing cover crops on arable farms due to the later Scottish harvest narrowing the window of optimal conditions. In 2023, Stuart McNicol, the East Lothian Monitor Farmer, direct drilled cover crops which grew, but not enough to merit a sheep grazier using the crop.

Cover crop establishment techniques being investigated include:
- Broadcast and roll
- Disc drill - Bednar (farm standard)
- Tine drill - Claydon

The trial aims to identify the most effective techniques for East Lothian conditions, considering factors such as soil type and climate. In autumn 2024, the trial included three widely used seed mixes:
- Buckwheat 96%, Phacelia 4%
- Buckwheat 60%, Crimson clover 40%
- Buckwheat 75%, fodder radish 25%

As part of the trial, soil testing is being carried out and assessments of rooting depth and soil structure.

In the first year, the late harvest led to a difficult year to establish cover crops, even those drilled in late August.

The Bednar drill was the only method to produce a viable crop, with fodder radish being the most prominent. For 2025, the project will use the Bednar drill immediately after harvest and compare the establishment of brassica varieties with the intention of grazing these. The trial is also considering using a drone to drill into a standing crop a couple of weeks prior to harvest.

STUART'S VIEW:

You can read a lot about cover crops and have lots of information, but this is really about how they perform on this farm, with our soil and machinery and the benefits at the end.

With the risk of crops not establishing due to weather and soil conditions, cost will continue to be a focus. Separately to this, the cost-benefit of cover crops to arable farmers and graziers is being assessed, based on two East Lothian farmers who have a long-standing cover crop grazing agreement. For growers, it is assessing costs such as seed, planting and potential yield changes, and benefits such as improved soil health.

For graziers, analysis will explore the value of cover crops as a forage source, offsetting feed costs and improving livestock health. It will help quantify the economic and environmental trade-offs for each party, guiding future decisions on the viability and benefits of cover crops.

GENOMICS: SELECTING REPLACEMENT SUCKLER HEIFERS FOR SUITABILITY AND LIFETIME PROFITABILITY

Banff and Buchan Monitor Farmer Bruce Irvine selects replacements for his herd by observation and works closely with Buchan Vets to carry out tests, including pelvic scoring, on potential replacement heifers. In 2024, he introduced a third factor – genomic data.

Testing hair or tissue samples from heifers allowed Bruce look at their genetic analysis and compare them with a one million-strong cattle database developed by Zoetis. This provided comparative information on key traits such as fertility, ease of calving, temperament, calf birth weight, feed efficiency teats, udders and feet.

While Bruce's Stabliliser bulls have an existing genetic profile, testing heifer genetics will mean he selects the best replacements for traits including fertility and temperament. It will also allow better selection of bulls for first calving heifers, to reduce calving issues and improve neonatal health.

Lessons learned from the trial include testing earlier to allow more time for deselection decisions on genomics results and to use a tissue tag rather than hair. Overall, there is a lower sample failure rate from tissue rather than hair as tissue samples usually lead to more reliable DNA extraction.

Tags and testing combined cost £31 per heifer, with return on investment coming from identifying and removing animals Bruce would otherwise breed from. The benefits increase the more years it is done.

Genetic profiling allows you to select by traits, so selecting for maternal traits, for finishing, or, in Bruce's case, the best of both.

HEIFER SELECTION AT BANFF AND BUCHAN MONITOR FARM

STEP 1 – Bruce filters his initial batch of heifers on three criteria:
1. Weight (targeting about 400kg at bulling)
2. Phenotype, especially feet and legs
3. Temperament and dam temperament

STEP 2 – Then, after a vet check, he selects for:
1. Capacity to breed
2. Pelvic score

STEP 3 – In 2024, Bruce introduced genomics for heifers which passed his initial selection:
1. Hair samples were collected from 17 heifers
2. Genomics results allowed the selection of 13 replacements
TOTAL COST FOR GENOMIC WORK WAS £467

	ZTR	ZCC	ZFC	£P
	323	184	164	21,407
	320	185	153	21,135
	304	142	160	19,885
	294	175	157	19,518
	293	142	164	19,396
	292	154	162	19,879
	292	170	151	19,695
	289	166	149	21,528
	289	151	150	17,135
	288	156	138	21,532
✶	283	159	144	24,596
	279	166	150	16,754
	279	149	137	19,007
	270	133	144	18,151
	262	148	136	19,123
	257	119	145	17,686

The genomic results (above) help Bruce choose his replacements:
- ZTR gives anticipated total return based upon maternal and terminal traits
- ZCC helps choose maternal traits in replacements
- ZFC gives an indication of efficiency and finishing of stock
- £P gives a predicted total return over a lifetime

✶ Bruce selected those above the yellow line.

BRUCE'S VIEW:

Genomic testing has identified that there is a £43/year difference between our best heifers and those which are 'average' and it is one of the projects I am most excited about. I think this could be the best tool yet for suckler producers.

USING FARMAX: ASSESSING FARM BUSINESS OPTIONS

Computer software for grass management decision-making has prompted change on two of the Monitor Farms – Dumfriesshire and Deeside.

Farmax, a program developed in New Zealand, helped simplify and support decisions about the businesses' direction by analysing biological and economic data from the farms.

It models pasture supply against stocking demand and incorporates economic factors, allowing farmers to develop informed, viable strategies.

It helps in-season decision-making by forecasting grass surplus or deficit, allowing for cost-effective decisions during the season. Critically, it also helps with longer-term strategic decision-making, critiquing current strategies and testing 'what-if' scenarios to evaluate potential alternatives.

RICHARD'S VIEW:

I always like a goal to chase, otherwise I feel like I am treading water – but now I know what we are chasing. For us, production is key.

DUMFRIESSHIRE MONITOR FARM
ASSESSING THE WHOLE FARMING SYSTEM

Using Farmax has allowed Dumfriesshire Monitor Farmer Richard McCornick to assess his options and look at how he could change his farm system. This is part of a larger project looking at Barnbackle's sheep management, aiming to help Richard enhance flock health and productivity, reduce costs and improve lamb finishing rates.

SAC Consulting's sheep and grassland specialist Poppy Frater worked with Richard, using Farmax's strategic decision-making help to answer questions he had about the business' future direction:

1. What are the implications of moving away from autumn calving on profitability and cashflow?

2. Should the business mate ewe lambs or not?

3. Is it worth keeping and growing lambs and calves longer to help with cashflow?

4. Is it possible to increase ewe numbers at Barnbackle?

5. Is later lambing a viable and more profitable option for Barnbackle?

6. What about a split lambing scenario, dividing the flock evenly between March (indoors) and April (outdoors)?

7. What about lambing the early flock one week earlier than the baseline (starting March 1)?

Based on the data in Farmax from Barnbackle, the answers are:

- Richard should continue to shift calving to spring as this leads to profitability improvements.

- Not mating hoggs will lead to a lower potential lamb crop next year but saving more lambs with better ewe feeding, hygiene and staffing protocols is possible and will offset the loss of income. This analysis does not factor in the benefit of not lambing ewe lambs to reduced mastitis and associated high culling rate.

- There are indications that keeping lambs to sell as hoggs will benefit profitability, although this is highly price sensitive. This could be done in the medium term to improve cashflow.

- In the long-term, the Farmax work suggests that moving towards later lambing and 100% spring calving is the most profitable model for Barnbackle, although Richard and his partner Hayley may opt for a split of March and April lambing for improved resilience to price and input fluctuations.

- Keeping 1,000 ewes will improve profitability, even with greater fertiliser dependency, with urea at £340/tonne and compound (27.0.0.8) at £300/t at the time of the research. Reducing ewe size will help but still requires additional fertiliser and thus increases fertiliser dependence compared with the base.

- The Farmax answers are based on grass growth assumptions of 7t of dry matter per hectare (2.8t DM/acre) at Barnbackle. Measuring actual grass covers will help validate these assumptions.

FARMAX ON DEESIDE MONITOR FARM ON P12 ▶

DEESIDE MONITOR FARM
ENTERPRISE SCENARIO PLANNING

Long-term scenario planning using Farmax software has allowed Deeside Monitor Farmers Duncan and Claire Morrison to successfully finish bulls at grass, reducing costs significantly.

With a focus on keeping variable costs to a minimum, rotational paddock grazing on high quality grass was already a key part of the system. Using Farmax, they have been able to look at different scenarios which has led to change.

The start of calving has been pushed back a week, while setting up winter or deferred grazing has helped with managing spring and summer grass availability.

Identifying that he had extra grass over summer and had previously spent thousands on feed to finish bulls inside, Duncan decided to experiment with finishing them at grass. Bulls were split into two groups at turnout in April; those more than 350kg and those weighing less than that, and both groups moved paddocks every two days or so. Bulls were offered about 1kg/head of concentrate pre-turnout, which continued in the field in mid-April, with rates increased towards finishing. Total feed use was 17t.

DUNCAN'S VIEW:

Farmax has helped me understand our own business and where the pinch points are for feed supply. For instance, I know if we will be short of grass in spring and we can try to smooth out those bumps – it is about getting the most out of the farm.

Bulls were sold prime to Kepak prior to their 16-month birthday, with four to 12 animals sold every week between late July and mid-September. Average sale liveweight was 602kg, with a daily liveweight gain of 0.93kg/day over their lifetime. Average carcase weight was 325kg, with a killing out figure of 54%.

BULL FINISHING AT GRASS VS INTENSIVE (PER HEAD)

- **Total variable costs:** £217 at grass vs £629 intensive
- **Purchased concentrate feed:** £157 at grass vs £546 intensive
- **Gross margin (inc. all forage costs):** £501 at grass vs £184 intensive
- **Net margin (inc. fixed costs):** £229 at grass vs £96 intensive

SAC senior beef and sheep specialist Kirsten Williams costed the system *(see panel, left)* using the farm's figures, with the only subsidy included being the beef calf scheme. Grazed grass was costed at 6p/kg DM, calculated using the intake and weight of cattle over the grazing period.

Costs allocated to the grazed bulls allow for all costs from weaning in October 2023 though until sale, including additional haulage moving the bulls from the winter housing farm to another for grazing, time for bringing them in for slaughter selection and some repairs. Duncan says Farmax helped give confidence that the farm had enough quality pasture to finish bulls at grass and so could also run steers at grass if processor requirements change in future.

EID FOR HERD EFFICIENCY AND PRODUCTIVITY

Introducing electronic identification (EID) to the Roxburghshire Monitor Farm aims to simplify cattle management by improving operational efficiency and enhancing data-driven decision-making.

This project, which started in autumn 2024, aligns with the ongoing work with Nethergill Associates, which focuses on calculating Maximum Sustainable Output (MSO) for optimal profitability and sustainability *(see page 17)*. Using EID technology will contribute to achieving MSO by enabling precise tracking and management of livestock, maximising production efficiency while minimising inputs and environmental impact.

ROXBURGHSHIRE EID AIMS:

- Improved herd management through better data collection and decision-making
- Enhanced time efficiency by automating data collection and reducing manual record-keeping
- Insights into which EID tags offer the best retention and longevity, improving long-term cost savings
- Sharing of appropriate tagging methods and their importance for tag retention

Monitor Farmer Robert Wilson would like to be more efficient at using data in the field/yards; with the current setup, records are updated at home on a PC-based system. Implementing EID will help bring a more accurate and simple data capture process, automating data collection and processing.

One of the key challenges in the adoption of EID systems is the durability and reliability of EID tags. Tag retention rates vary significantly between brands, and poorly retained tags can lead to lost data, increased costs and inefficiencies. This project will help identify the most durable and cost-effective options for long-term use.

The trial will start using low frequency equipment as this is currently readily available, and is being hired from Blyth Livestock Advisory Services, which is also providing technical assistance for the trial. Following Scottish Government's announcement that Scotland will adopt ultra-high frequency (UHF) tags as standard, the project will then follow the journey of converting from LF to UHF or dual frequency as announcements progress.

ROBERT'S VIEW:

This is going to give us a lot of data at our fingertips, rather than having to work everything out, and it's an extra level of record-keeping which is really useful.

BOOSTING LAMB SURVIVAL

Lamb losses are a significant waste to sheep businesses, as well as impacting welfare, with poor colostrum quality and failure of transfer of passive immunity (FTPI) putting lambs at increased risk of death and disease.

KEY AREAS

This project, funded by Monitor Farm Scotland and Livestock Health Scotland, aimed to identify the risk factors on a commercial farm, and give guidance on how farms could ensure good lamb survival rates. Vet and researcher Ali Haggerty, from Stewartry Vet Centre, and colleagues at University of Glasgow School of Biodiversity, One Health and Veterinary Medicine looked at four key areas:

1. EWE BODY CONDITION: Monitored by body condition scoring of 10-15% of animals from each management group at key points in the season: weaning, pre-tupping, scanning and pre-lambing. The aim was to manage and maintain BCS and minimise losses in condition in late pregnancy.

2. FTPI: Initial research found that 17% of the 2024 lamb crop suffered from FTPI, which increases the risk of neonatal lamb morbidity and mortality.

3. COLOSTRUM QUALITY: Research found that 40% of samples were classed as poor quality, and poor colostrum quality was associated with poor levels of serum antibodies in lambs when blood tested.

4. FEEDING EQUIPMENT HYGIENE: Research found that 80% of 'point of feeding' supplementary colostrum samples failed total bacterial count thresholds, which may negatively impact lamb health.

ALI'S VIEW:

Colostrum is liquid gold. The aim should always be to ensure colostrum achieves as high as possible concentration of antibodies in the lambs' blood.

LAMB SURVIVAL FINDINGS

To address these issues, the farm put some key practical targets and management approaches in place, applicable across flocks:

- Focus on minimising BCS change, particularly in late gestation; maintain 2.5/3.0 from scanning to late gestation, aiming for more than 80% of the flock to be in BCS 2.5 at lambing. Research found flock level management decisions such as this have the biggest impact on colostrum quality.

- Focus on nutrition and feed access, so increase feed access in housed ewes during late gestation and at the point of lambing towards the AHDB recommended target of 15cm/ewe fed as ad-lib total mixed ration (TMR). Accurate measurements of feed space and stocking density are required.

- Review colostrum supplementation policy and aim to minimise the number of lambs routinely supplemented with colostrum. Priority should be to encourage lambs to suckle the ewe directly as this is the most hygienic way to deliver colostrum and promotes maternal bonding.

- Review colostrum storage and equipment hygiene. Clean storage and feeding equipment with a scrubbing brush, detergent and hot water after every use and buy multiple feeders to allow thorough cleaning after every use.

- Chill colostrum at 4°C for up to two days if not fed immediately to prevent bacterial growth. Alternatively freeze excess colostrum at -20°C for up to six months, thawing it in a warm water bath before feeding.

- Ewe colostrum is best for supplementation if can be stored appropriately – frozen promptly after collection and defrosted in a warm water bath.

FINE-TUNING NUTRITION:
BOOSTING STOCK PERFORMANCE AND REDUCING COSTS

Fine-tuning cattle rationing has helped maximise stock performance and make best use of home-grown feed and forage at the Strathspey Monitor Farm. An in-depth project involving feed budgeting, ration planning, data collection and looking at animal health and blood sampling pre-calving has resulted in better performance and cost savings running into thousands. It has allowed the Smith family to take more control over decision-making.

Initial work in autumn 2023 involved analysing silage for dry matter and feed value, weighing silage bales and measuring pits to find out what was 'in stock'. Then the different groups of cattle were added in and a feed budget calculated by SAC Consulting ruminant nutritionist Karen Stewart.

The feed budget spreadsheet was regularly updated throughout housing, ensuring rations were being fed in line with the forage and feeds available. Being able to carry out a mid-winter 'stock-take' means the Smiths can take action earlier if forage is looking short to prevent sudden ration changes at key times such as calving.

Rations were tweaked throughout winter, prompted by discussions between Malcolm Smith and Karen looking at the feed budget, any changes in bales or opening a new pit and cattle performance. Cows were managed and fed according to body condition score, but an outbreak of pneumonia among young cattle affected liveweight gain.

However, the Smiths used 16 fewer tonnes of barley over winter to achieve similar weight gains, saving £2,880 with barley costed at £180/t, says Malcolm. "The feeding recommendations have saved us a lot, and if the calves had not had the pneumonia outbreak, the weight gains would have been better too."

The approach continued in the 2024/25 winter, where, coupled with a rigorous approach to minimising pneumonia risk, the cattle achieved a daily liveweight gain of 1.3kg/head, as well as saving around 20t of barley.

MALCOLM'S VIEW:

It has been good to get back to proper rationing, like when I was dairying and worked with nutritionists all the time. It has been great to have the information at our fingertips.

WINTER NUTRITION

- Analyse forage – know what quality and quantity you have
- Work out your forage and feed budget
- Ration cattle to match forage available
- Adjust rations throughout winter as required
- Analyse forage again if it changes
- Assess stock performance (daily liveweight gain)
- Independent view may help with effective ration planning

OPTIMISING FARM MANAGEMENT:
CALCULATING MAXIMUM SUSTAINABLE OUTPUT

ROBERT'S VIEW:

Working out our MSO showed some things are not as efficient as they could be. Aiming for MSO is a change of mindset and much more forward-looking.

If you have ever wondered about changing the balance of enterprises on your farm, or where its 'sweet spot' for profitability is, working out its 'Maximum Sustainable Output' (MSO) may help. Work on more than 300 farms has shown it can optimise output, as well as improving profitability and environmental impact, with Roxburghshire Monitor Farmer Robert Wilson putting it to the test on his business at Cowbog.

According to its developer, Nethergill Associates, the MSO 'sweet spot' hinges around three key metrics. The first is the 'free energy', such as sunlight and rainfall, which shows what the land type is capable of producing. The two other metrics are variable costs, which are split and are the key to understanding what is happening in the business:

- Productive variable costs (PVCs) are those exclusively associated with working with nature and the other natural resources on the farm. These costs would include grass management, cultivating and harvesting. PVCs are linked to 'free-issue' resources.

- Corrective variable costs (CVCs) are those associated with substituting for nature or other natural resources. Typically, these cost items will be one of two types, either items that incorporate an industrial energy content, or items that correct for some disadvantages linked to latitude, elevation or rainfall. Costs include concentrates, fertilisers and silage production. They are always less energy efficient than productive variable costs.

The MSO is worked out by Nethergill after looking at the farm's accounts, costings and productivity, in conjunction with information about land type and environment; in total they look at up to 150 data points. All the information is combined and, using algorithms, graphs are produced showing the farm's 'sweet spot' or MSO.

By working in balance with nature, maximising the free energy, such as sunlight, at MSO, farm businesses can plan for maximum profitability. Where a farm is beyond its MSO, you cannot recover the additional energy costs in the product you are selling. On average, every £1 of revenue beyond MSO will cost £2.85. Of the 300-plus farms Nethergill has already assessed, only 7% were found to be at, or below, MSO. Those above MSO have worked towards it gradually through a variety of routes. This includes changing the balance of enterprises, so keeping more livestock and reducing arable, or the other way round, as well as focusing on reducing their 'industrial energy' or corrective variable costs.

ROXBURGH MSO CHANGES

- Better grazing use, including rotational grazing
- Reducing creep fed to spring calves at grass
- Better use of muck on grassland rather than bagged fertiliser
- Ongoing focus on lime and soil pH has helped improve growth
- Arable inputs carefully managed

ELECTRONIC RUMEN BOLUSES:
USE IN SUCKLER COWS FOR HEALTH, HEATS AND CALVING

The use of electronic boluses in the rumen in dairy cattle is well established, using movement and temperature sensors to measure rumination, body temperature and activity. For dairy farmers, data analysis, through apps, provides early detection and recording of bulling, calving, feeding issues and onset of illness. However, they are not currently widely used for sucklers.

Bruce Irvine, the Banff and Buchan Monitor Farmer, believes bolus technology could have cost-effective, labour saving and welfare benefits to suckler cow management. Now, his suckler herd is involved in a 'proof of concept' two-year collaboration with vets, nutritionist and bolus/software suppliers to examine efficacy, accuracy and cost-benefits of boluses, which could include improved detection of bulling, cattle illnesses and calving management.

KEY AREAS FOR THE TRIAL

- **HERD FERTILITY –** ensuring compliance with requirements for the Scottish Suckler Beef Support Scheme, which now requires tight calving intervals. The boluses will identify bulling behaviour and where cows do not 'take' to the bull. Bulling behaviour is associated with increased activity from the cow; the project will show whether this is accurately measured and displayed in real time by the bolus technology.

- **COW HEALTH –** vital for its own welfare, for its fertility, efficiency and ability to raise a calf. Cattle frequently show few signs of infection at an early stage, succumbing only at a point where farmer and vet intervention is required. The project will test if early detection of body temperature rise and changed behaviour can be detected by the bolus to provide alerts and early intervention.

- **CALVING SUCCESS –** a busy time on farm, the project will test whether a bolus can detect the onset of birth, along with length of time in labour. Will early detection of calving help Bruce to better manage labour and prioritise attention to cows which may require assistance with calving?

Working on tightening his calving and lambing period will bring benefits in cow fertility, calf management and batching through the year, but it also places a significant workload pressure on Bruce over a six-week spring-calving period. Further workload pressure occurs during bulling, which coincides with silage, and throughout summer, where mastitis can be a problem, particularly after weaning.

Bruce investigated two differing systems at similar costs which offer remote sensing of cattle health and movement, with data transmitted to a base station, processed in the cloud and sent via an app to smart devices.

He has settled on trialling the smaXtec cattle boluses, which involves a one-off application and then measures body temperature and rumen activity.

The company guarantees free replacement for damaged, non-working and lost boluses, with battery life stated as five years or greater. The bolus monitors every 10 minutes and data uploads every half-an-hour to the cloud, through one or more base stations located on the farm. The system will alert Bruce when cattle movements indicate illness, heats or unusual rumen activity, allowing him to take action.

BRUCE'S VIEW:

I think this technology could be game-changing, but suckler cows kept outside are very different to dairy cows, so it's a really good learning experience for everyone involved.

The smaXtec software and data will be shared with Ewan Jamieson, vet director at Meadows Vets, who is providing an independent assessment of the benefits of the boluses and software on Bruce's farm, while a cost-benefit analysis will be done at the end of the project.

Bruce calves outside in three groups across the farm and hopes the system will allow him to observe cattle remotely at times during the main spring calving period and target visits more effectively, particularly at night, reducing personal stress and tiredness.

If the trial proves successful, the bolus system would offer remote sensing of cattle health, a valuable option when it is difficult to recruit qualified stock people, which contributes to a reduction of herd size or limits herd expansion.

PLOUGHING VS DIRECT DRILLING:
THE EFFECT ON NITROGEN USE EFFICIENCY IN SPRING BARLEY

This on-farm demonstration trial will help assess the impact of ploughing versus direct drilling on nitrogen use efficiency (NUE) in spring barley. Part of a UK-wide focus on nitrogen by AHDB, it is running on the East Lothian Monitor Farm, farmed by Stuart McNicol and his father Bill.

While there is plenty of information available on links between cultivation intensity and environmental risk management, the trial is designed to demonstrate a baseline effect on the East Lothian farm, and to generate discussion and innovative thinking.

Through soil sampling, nutrient planning, plant tissue testing, yield analysis and grain nitrogen sampling, the demo is looking to understand the agronomic implications of tillage practices on nitrogen utilisation throughout the crop cycle.

At harvest, a portable weighbridge will ensure accurate yield measurement, as this data directly influences the calculation of NUE, while an in-depth report will detail cost establishment to look for instant cost savings in the following drilling season.

STUART'S VIEW:

This demo should help us understand the best options for this farm. The first year gave the opposite result to what we expected and I think we can sometimes forget how weather-driven farming is.

The demo began last March, when samples were analysed from the field, one half of which was direct drilled, the other half ploughed, with sampling repeated in October. The field received 115kg N/ha (46.5kg N/acre).

At harvest, the ploughed area yielded 4.56t/ha (1.85t/acre), while the direct drilled area yielded 6.1t/ha (2.47t/acre). Both samples made malting spec, with the ploughed half at 1.16% grain N and direct drilled at 1.4% grain N. Soil tests showed there was more soil N available in the direct drilled soil post-harvest.

However, the data from one season is not enough to be conclusive. The demo is being repeated this year, with soil samples already taken this spring. Plant counts and tissue samples will also be taken.

The eventual findings will inform plans and growing practices at the East Lothian Monitor Farm, including adjusting tillage practices based on the calculated NUE and yield outcomes.

AHDB has a network of field demonstrations across the UK within the Monitor Farm network under the broad topic of 'nitrogen', all collecting the same basic measurements. They are designed to foster conversation and share practical case studies.

EAST LOTHIAN NUE DEMO

By comparing ploughing and direct drilling, the demo will identify:

- Which method optimises nitrogen utilisation, potentially leading to cost savings
- A better understanding of how to maximise crop productivity in spring barley
- It will also help to ensure sustainable farming practices, reducing environmental impact

FORAGE CROPS AND OUTWINTERING STOCK

With unpredictable weather patterns, livestock outwintering systems have been challenged recently. To assess potential, build resilience into systems and manage crops in a challenging climate, four members from the Deeside Monitor Farm management group shared their experience of various options over the 2024/25 winter.

The project, facilitated by Kirsten Williams, SAC Consulting senior sheep and beef consultant, involved:

DUNCAN AND CLAIRE MORRISON, TORPHINS – Monitor Farmers, built on their outwintering experience through managing deferred and bale grazing and kale for their cattle.

ROBERT MARSHALL, LUMPHANAN – grew a hybrid rape and yellow swede mix grazed overwinter by spring-calving cows and in-calf heifers, with baled silage sited in one field pre-grazing.

JONNY STEWART, DRUMOAK – grew fodder beet and swedes for outwintering sucker cows behind an electric fence, with an arable stubble backrun and hay.

ALEX STEPHEN, EDZELL – grew fodder beet for ewes to reduce concentrate use pre-lambing, a forage brassica mix for grazing lambs and stubble turnips for grazing with dairy cross growing stirks.

Karen Stewart, SAC Consulting ruminant nutritionist, worked with the group to ensure crops were meeting animal requirements for the stage of production.

The lowest cost crop/kg DM to establish was deferred grazing at £0/kg DM, followed by the stubble turnip catch crop (£0.02/kg DM). In terms of energy cost, deferred grazing again stood out due to no establishment costs, with the stubble turnips catch crop costing £0.014/MJ ME.

Protein far exceeded traditional book values in some cases, the best being the stubble turnip catch crop and kale, due to low establishment costs in these systems.

With 10 crops over very different farms, comparison is challenging, but livestock units grazed (LU)/ha stood out at 16.88LU for suckler cows on beet, with a low of 2.40LU on the stubble turnips.

When total cost of the forage crop plus supplementary feeding was taken into consideration, the lowest cost/kg LW carried was the deferred grazing, with stubble turnips the highest.

FORAGE CROPS: THE AVERAGES

- **Establishment cost/kg DM:** £0.048
- **Energy cost/MJ ME:** £0.033
- **Protein cost/kg:** £0.014
- **Livestock units/ha:** 9.27

KIRSTEN'S VIEW:

While there are clear winners for individual performance, the choice of crops grown was driven by space and resources available on farm, so a farm with a limited acreage required higher stocking density and therefore a higher yielding crop on a smaller area.

DEVELOPING A PROFITABLE SUCKLER COW CALCULATOR

Work on the suckler herd at the Argyllshire Monitor Farm will result in the creation of a Profitable Suckler Cow calculator – a development where, alongside physical traits used for heifer selection and culling policy in a herd, the cost of feeding a cow over winter could be calculated and used for a robust decision-making process. Craigens Farm on Islay has developed a herd of Angus cows and an outwintering system on deferred pasture to reduce winter feed costs.

CRAIG'S VIEW:

There is so much data you can collect on your suckler cow. This project has helped us to focus on the priority areas for our herd and systems and cut out a lot on noise.

The Integrated Land Management Plan showed there was scope to further reduce feed costs through youngstock rations, refining the wintering system and using data-driven breeding for a more efficient cow with a lower mature weight to better suit the system. A focus on nutrition is also helping tackle a consistent 7% barren rate and reduce creep feeding to calves.

SAC Consulting ruminant nutritionist Lorna Shaw has been working with the family, with work including putting in place winter rations for sucklers based on forage quality available, aiming to maintain performance and using forage and draff available on the island.

She has also reviewed all the data available, including cow weight, cow Body Condition Score, calf performance (weights and daily liveweight gain) and has quantified cow efficiency in the herd. This has been possible in part as the Archibalds have improved their data collection and use of software, buying a tablet to automate data collection at handling and boosting Wi-Fi in the shed where they weigh cattle.

The project is looking into the profitability of individual sucklers based on cost of cow keep (feed intake, ration cost, fuel and electricity at housing) and by calf value at weaning to look at potential margin of the calf over cost to keep the dam. This will be fine-tuned to take into account lower costs while outwintering and to include accurate predictions of fuel, electricity and labour at housing. This data will form the basis of the profitable cow calculator.

One of the key areas of work is reviewing the herd's breeding goals for better heifer selection. Traditionally, heifer selection at Craigens was done on weight at time of selection. All data was reviewed using the following selection criteria (with herd goals in bold). Heifers were sorted by 200-day weight and current weight, and all calves must also meet the following criteria in order of priority:

- A dam with a calving interval of fewer than 400 days – **fertility**
- A daily liveweight gain of more than 0.9kg – **growth potential**
- Ideally, dam's BCS between 2.5-4.0 – **BCS management (potential to outwinter)**
- A decent cow efficiency of more than 32% - **productivity, aiming for 42% target ideally**

Initially, single-born calves were prioritised due to a high twin rate in the herd, but some twin calves may be considered for selection if needed. Temperament and dam calving ease should also be considered, but this was not available in the main data set. The final stages of the project will pull all the information together to finalise a profitable cow calculator and quantify the criteria which makes a suckler cow successful in an island-based production system.

PROFITABLE SUCKLER COW TOOL

- Clear recording protocols for calving, weighing and scoring is improving accessibility of data capture.
- Clear analysis strategy being developed alongside set breeding objectives and selection protocols.
- Data from previous/current years being analysed to assess trends in production, including cost of production from ration and budget to assess cost of keep.
- Target is to introduce a new decision tool based on suckler cow efficiency and cost of production.

MEET THE MONITOR FARMS

ARGYLLSHIRE

Craigens Farm is a 2,000ha (4,940ac) tenanted unit on the west coast of Islay run by Craig and Petra Archibald, Craig's father and Craig and Petra's three children.

They have 220 suckler cows and 200 stores, as well as 1,000 ewes and between 1,000-1,200 lambs. The farm focusses on producing Angus and Charolais yearling calves for the store market and prime lambs. In addition to the livestock, the farm has 20ha (49ac) producing barley grown for a local distillery and 10ha (24ac) of forage rape.

Geese grazing places the farm under heavy pressure during winter and Craigens Farm is in Goose Management Schemes. Most tasks are carried out in-house with their own machinery. As a result they do some contract sowing with a moor drill and sward lifter. The business has diversified into oyster farming and opened an on-farm café in November 2022.

BANFF AND BUCHAN

Sauchentree Farm, at New Aberdour, on the north-east coast of Scotland, is run by Bruce Irvine in partnership with his mother. Help at lambing comes from his art lecturer wife, sister and brother-in-law, and their two daughters are starting to get involved in the farm. The family has been at Sauchentree for over 200 years.

In total, Bruce farms 263ha (650ac) with cereals, sheep and cattle. Bruce believes the three enterprises are as important as each other, with livestock providing fertility for the arable side. Bruce markets their lamb and beef through Woodhead Bros, Turriff and ANM at Thainstone and enjoys competing with neighbouring farms on yield and lambing percentage.

DEESIDE

Meikle Maldron, in the north east of Scotland, is run by Duncan and Claire Morrison, who moved to the farm in 2016.

In total, Duncan and Claire farm 248ha (612ac) across three farms as a wholly suckler enterprise, with 250 suckler cows and heifers going to the bull in 2024, comprising commercial Aberdeen-Angus and pedigree Aberdeen-Angus and Stabilisers.

They own 200 and lease a herd of 50 Stabiliser cows. Most Stabiliser bull calves are finished, some breeding heifers are sold at 12-14 months and the rest are sold as stores. Duncan and Claire bull around 50 heifers each year. The Morrisons grow 15ha (37ac) of arable silage and 8ha (20ac) of kale.

DUMFRIESSHIRE

Barnbackle is a 202ha (500ac) beef and sheep farm run by Richard McCornick and partner Hayley Currie, with Richard's parents, Andrew and Janice, with 178ha (440ac) owned and the remainder rented.

There are 150 suckler cows, 20 store cattle and 700 ewes at Barnbackle. The cows are Sim-Luings and calve in spring and autumn. Most calves are sold as sucklers with only a small number kept through winter. Richard also runs a small herd of pedigree Charolais cattle, supplying local farmers with bulls to meet their requirements.

Some of the cattle are out wintered on kale. The sheep also winter on kale, as well as swedes. Ewes are Texel cross Mules and all the lambs are sold off grass.

EAST LOTHIAN

Castleton Farm is a 169ha (418ac) farm run by Stuart McNicol and his father Bill, who works on the farm part-time. Stuart's wife, Jo, manages the agritourism enterprises.

The arable acreage produces wheat, malting spring barley, spring beans and cover crops, which are grazed by sheep. Stuart only ploughs when necessary, with most crops established with a strip-till. He uses variable rate applications at drilling and for applying fertilisers and lime. Stuart has an arrangement which has 75 Hebridean sheep on the farm year-round, and another which brings in 250 Blackface sheep at certain times of the year.

The business has diversified into storage units for let, a wedding venue, a bakery kitchen on farm for Drift – their diversified coffeehouse – and have recently planted 2,000 fruit trees for juicing and future cidery. They have also diversified into 'Seek', a secure dog walking field, while 'Escape Sauna' has just opened at Drift, where they are also currently awaiting planning permission for a 65kW solar system.

ROXBURGHSHIRE

Cowbog is a mixed tenanted farm with a contract farming arrangement running over two further holdings with Roxburghe Estates. In total, Robert and Lucy Wilson, together with Robert's parents, farm 242ha (598ac).

They have 100 suckler cows plus followers, all of which are pure-bred Herefords. Calving is currently split 80% in spring, 20% in autumn. Cattle feed is mainly forage-based and some cattle are outwintered. Breeding bulls and females are sold from the herd and animals not fit for breeding are generally finished. A few animals are sold through the farm's new agritourism diversification – Wilson's Farm and Kitchen.

The Wilsons also have a small flock of sheep and 160ha (395ac) in arable or forage production over the three farms. The cropping regime is predominantly spring malting barley with a small amount of winter barley and winter wheat. Arable silage, kale for outwintering and EFAs make up the remaining area.

SOUTH AYRSHIRE

A total of 716ha (1,770ac) are farmed by John and Allison Andrew in partnership with son David. Rowanston comprises 129ha (320ac) of owned land, with an additional 40ha (100ac) of neighbouring land rented annually. The 546ha (1,350ac) hill farm of Blair lies three miles away and is rented on an MLDT from Kilkerran Estate.

Livestock consists of 150 hill suckler cows with replacements home-bred and all progeny finished on farm. About 200 store cattle are bought-in for finishing each year. There are 1,000 breeding ewes in total with 550 hill ewes and 450 lowground.

About 40ha (100ac) of feed crops are grown comprising winter and spring barley, spring oats, wholecrop spring wheat, swedes and fodder beet. Silage chopping, combining, drilling, spraying, hedge-cutting and umbilical slurry spreading are carried out by contractor. All other operations are done by the Andrew family and their one full-time employee.

STIRLINGSHIRE

Lands of Drumhead and Blairfad total 505ha (1,250ac) and are situated on the boundary of the Loch Lomond and the Trossachs National Park, near Gartness hamlet in the Endrick valley. They are farmed by the Duncan family, who have a stratified system with the hill farm at Inveruglas producing replacements for the lowland units.

Two of Bruce and Shona's four children have already returned to the farm from full-time education and are becoming increasingly involved in the running of the farms, with Gregor also returning home after working in New Zealand this winter. Bruce's parents and father's cousin also continue to be involved at their respective holdings. The 30 hill suckler cows and 1,300 Blackfaced ewes at Inveruglas have been the basis of the herds and flocks at Lands of Drumhead and Blairfad. In total, the Duncans are calving 180-190 cows each year and have a flock of 2,300 sheep.

STRATHSPEY

Auchernack is a 323ha (800ac) farm in Strathspey. The family have farmed here since 1936. Today, it is run by Malcolm Smith. He farms alongside his sons Calum, who is employed full-time, and Hamish, who works part-time. Sammie, Malcolm's wife, is also a partner in the business and she runs a successful self-catering business.

The family has 150 suckler cows and 135 store calves. The focus is on store calf production using predominantly Limousin sires. A Shorthorn bull was used for the first time in 2023. For ease of management, cattle are overwintered indoors. Calving is split, with a third of the herd calving in autumn/winter and the remainder in spring.

PROJECT COLLABORATORS

AHDB

Blyth Livestock Advisor Services
B.L.A.S. Specialist in livestock data capture & Use:

SRDP Farm Advisory Service

LIVESTOCK HEALTH SCOTLAND

meadows vets

monil

Nethergill associates

NORVITE
SPECIALISTS IN ANIMAL NUTRITION

SAC CONSULTING
Part of Scotland's Rural College (SRUC)

smaXtec

STABILISER CATTLE COMPANY

THE STEWARTRY VETERINARY CENTRE
Castle Douglas & Dalbeattie
Tel: 01556 502263

University of Glasgow
School of Biodiversity, One Health & Veterinary Medicine

zoetis

MONITOR FARM Scotland

FIND OUT MORE ABOUT THE MONITOR FARM PROGRAMME

Find out more online, including meeting reports, technical advice and Monitor Farm updates, plus meeting dates: **monitorfarms.co.uk**

Follow us on social media:
monitorfarmscotland
monitorfarms
monitorfarmscotland

Watch us on YouTube: **youtube.com/@monitorfarmscotland**
Check out our podcast: Field Talk: A Monitor Farm Scotland podcast available on Apple Podcasts, Spotify and more

Contact: **monitorfarm@qmscotland.co.uk**