RHWYDWAITH ARDDANGOS DEMONSTRATION NETWORK

FARMING connect
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# Demonstration Network:

## on-farm projects 2019-2022

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#einffermydd
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RHWYDWAITH ARDDANGOS DEMONSTRATION NETWORK

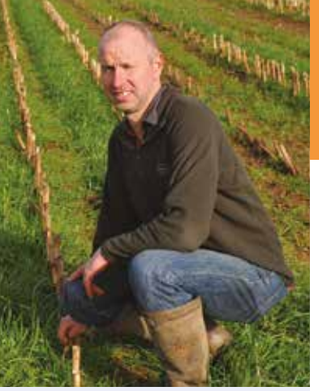
## FOREWORD

Farming Connect's role is to inspire and challenge farmers throughout Wales to achieve the best from their farming systems, to run competitive, resilient and sustainable farm and forestry businesses. Since 2019, a network of 18 demonstration site farmers and 38 focus site farmers have been supported by industry experts to implement and demonstrate innovation and new technologies. Within the network, all of the work falls under Farming Connect's three main themes: land, livestock and business. These cover many key topics, including animal health & welfare, soil management, grassland management, new technology, woodland management and carbon.

Through this work, farmers have learned which systems work well and which do not, by implementing new or different approaches to achieve their goals. They are now in a stronger competitive position, better-placed to deal with market volatility, to thrive and prosper. This booklet provides a snapshot of the work undertaken over the last three years. We hope that you too will be inspired and encouraged as you see what has been achieved by implementing innovative ways of working and introducing new technologies to improve performance, and consider how you can increase the long-term sustainability of your business.

Eirwen Williams
Director of Development

Further information and resources on all the projects within this booklet and other projects across the Demonstration Network are available on the Farming Connect webpage.



# Arnolds Hill Farm — Mathew van Dijk

## PROJECT 1:
Undersowing maize for environmental and economic benefit

**LOCATION:**
**Haverfordwest**

**FARM:**

Arable and Red Meat
121ha in total
28ha maize on contract
15ha winter cereals
60 Limousin suckler cows
Sheep grazed on tack

## FARM OBJECTIVES

1. Simplify management system to accommodate off-farm work
2. Generate income to cover purchase of additional land
3. Keep capital inputs low

### PROJECT FACTS:

- Undersowing costs of grass seed and drilling were £87/ha
- Sheep grazing days increased to 1,048/ha
- Return from sheep tack grazing was £135/ha
- Eliminated harvest machinery damage and soil run-off over winter

### Background:

Climate change is delivering more winter heavy rainfall incidences, and river monitoring has indicated that this is accompanied by spikes in river phosphate levels, which has been attributed to soil run-off. Leaving maize stubbles bare over winter is therefore not sustainable, but planning to establish a crop or cover after maize harvest can be problematic because of autumn soil conditions and late sowing.

In Denmark, thousands of hectares of maize are undersown with grass seed, and extensive trial work there has provided guidelines to ensuring good establishment.

### What are the benefits?

✓ Reduces soil erosion
✓ Builds fertility
✓ Builds organic matter
✓ Retains soil nutrients (+/- 40kg/ha N + K)
✓ Enhances soil structure
✓ Easier preparation of spring seedbeds
✓ Cross-compliance good practice
✓ Provides winter/spring grazing opportunity

### Purpose of work:

1. To protect soil structure at maize harvest and prevent soil run-off over winter
2. To provide an income from grazing sheep on tack

### Approach:

A 5ha field situated on a slope and sown with Augustus maize was chosen, and four trial plot areas were established by undersowing into the standing maize crop on 2 July using a Zocon tine drill:

**Plot 1 -** Italian ryegrass (IRG) blend sown at 17.3kg/ha. IRG is vigorous and economical to use as a short rotation crop.

**Plot 2 -** Straight tetraploid perennial ryegrass sown at 19.8kg/ha. This has the potential to graze better quality grass if left through to the next season (leafier and will head later).

**Plot 3 -** Italian ryegrass and winter vetch sown at 29.6kg/ha. Vetch increases the protein content of the grazed material, will fix nitrogen (N), and its extensive rooting system benefits soil structure.

**Plot 4 -** IRG and Berseem clover sown at 19.8kg/ha. Berseem clover provides for rapid biomass cover and the ability to quickly fix nitrogen.

*Figure 1: Drilling the cover crop plots 2 July 2021*

### Outcomes:

All the grass plots established well, yielding an average of 2.5-3.0 tonnes DM/ha with the two plots based on IRG providing the highest covers. There was no apparent impact on maize yield, with the crop averaging 43t/ha, similar to previous years when the crop was not undersown.

The maize was harvested on 16 October. There were only very minimal wheeling imprints left by harvesting machinery, resulting in no visible water run-off from the tracks, following 25mm rainfall on 17 October.

Ewe lambs being wintered on tack were turned into the field in December, and 160 lambs were grazed for 17 days, followed by another seven days in February. In April, the field supported grazing for another 70 store lambs for 20 days, plus 12 young cattle were turned in to clear the field.

**Undersowing costs and grazing returns**

**Grass seed (Italian ryegrass option) 5ha @ £50/ha = £250**
**Drilling grass seed 5ha @ £37/ha = £185**
**Total undersowing costs = £435**
**Total sheep grazing days achieved = 5,240**
**Return from tack grazing (90p/head /week) = £674**



# Bodwi — Edward & Ellis Griffith

## PROJECT 1: Revising the bull beef enterprise by exploring the potential benefits of homegrown crops

**LOCATION:**
**Pwllheli**

**FARM:**

Red Meat
247ha in total
4.5ha woodland
15ha spring barley (in 2021)
Rotational grazing
125 Stabiliser suckler cows
1,170 Suffolk X ewes,
320 ewe lambs
Calving in February - March
Lambing January - March
Glastir
Holiday lettings/Caravan site
Wind turbine

## FARM OBJECTIVES

1. Keep control of variable costs, rear as much as possible from home-grown production
2. Compare the profitability of different beef finishing systems
3. Keep increasing EBV level of the suckler herd to maximise breeding sale potential

### PROJECT FACTS:

- The cost of production was less for the bulls finished on the farm at £1.62/kg LWG, in comparison with £1.73/kg LWG at the specialist unit
- Switching to finish all bull beef on-farm on a diet of homegrown treated barley and silage in Year 2 resulted in a saving of £0.45/kg LWG on the cost of finishing
- Switching to finish all bull beef on-farm on a diet of homegrown treated barley and silage in Year 2 resulted in a reduction of 9.8% in the whole farm $CO_2$e emissions per kg of farm output

### Background:

Bull beef are efficient animals to fatten, due to their high feed conversion and compensatory growth. As the bulls are often fattened by the age of 13-15 months, the intensity of these finishing systems tends to be high, with substantial inputs required.

Fluctuating beef prices, as well as the increasing cost of purchasing concentrate feed, resulted in exploring the potential of finishing bull beef on a diet based on homegrown feeds at Bodwi, as opposed to the usual system of finishing on purchased concentrates.

### Purpose of work:

1. To calculate the cost of production of the historic finishing system on the farm, whereby all feed was bought in
2. To determine the effect of adapting the feeding system (i.e. growing and feeding spring barley) on the profitability of the bull beef enterprise
3. To assess the impact of switching to finishing the bull beef on homegrown feed, as opposed to purchased concentrates on the farm's carbon footprint

### Approach:

The cost of production of the usual bull beef finishing system was calculated, where half of the bulls were finished on-farm on a diet of ad-lib beef nuts and straw, and the other half finished on a Total Mixed Ration at a specialist finishing unit. In Year 2, a crop of spring barley was grown, and all bulls finished on-farm on a diet of homegrown silage and treated barley. The cost of production for Year 2 was calculated and compared with that of Year 1. Bull performance was monitored from weaning up to finishing in both years. The carbon footprint of the farm was also calculated and compared for both years.

### Outcomes:

In Year 2 (2020-2021), the bulls were kept in one group, and the cost of finishing on homegrown feed equated to £1.17/kg LWG. This resulted in a saving of £0.45/kg LWG on the cost of finishing in Year 2, compared to on-farm in Year 1 (Figure 2). Bull performance was not compromised, with the bulls slaughtered at 13-15 months old.

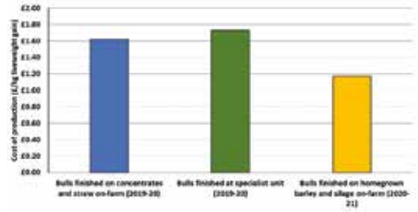



*Figure 2: The average cost of production (£/kg LWG) of each finishing system compared in 2019-20 and 2020-21.*

A switch to finishing the bull beef on a homegrown diet resulted in a reduction of 9.81% in the whole farm carbon dioxide equivalent ($CO_2$e) emissions per kg of farm output. When focusing on the bull beef enterprise alone, the $CO_2$e emissions per kg of liveweight were over 3kg $CO_2$e/kg lwt fewer in Year 2 than Year 1.

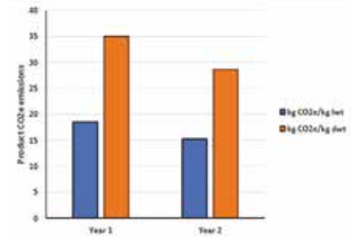



*Figure 3: Product $CO_2$e emissions per kg liveweight (lwt) and deadweight (dwt) of beef.*

### How to apply on your farm:

☑ Know the target finishing weight *(liveweight or deadweight)* of your stock and the daily liveweight gain required to achieve this
☑ Consider the farm's suitability for growing homegrown crops *(land availability, what can be grown on the farm, feeding requirements)*
☑ Consider stock requirements when selecting diet options *(starch, energy, protein)*
☑ Analyse nutritional quality of silage

"Becoming a demonstration site was a great opportunity for us to learn and gain more information about various topics, as well as generate new ideas for the farm."

# Bodwi

## Edward & Ellis Griffith

## PROJECT 2: Determining the effect of sulphur application on silage yield and quality

### PROJECT FACTS:

- The silage booster fertiliser increased the selenium content of the forage in both the fresh grass and the silage – by approximately five times in the fresh herbage, and two to three times in the silage
- Increased yield of 5% was recorded at the first cut
- The silage analyses highlighted higher metabolisable energy, crude protein and sugar content from the booster treatment
- Metabolisable energy and crude protein content were very variable in the fresh grass analyses, but increased sugar levels were evident in the booster treatment

### Background:

Sulphur is generally considered a secondary nutrient, after nitrogen, phosphorus and potassium. Nevertheless, its importance for nitrogen uptake, increased protein and sugar levels, and consequently, improved grass yield, is increasingly recognised. Despite this, sulphur deficiency is often identified in grassland trials, which can negatively impact animal performance. Increasing sulphur and selenium levels in grassland via the use of fertilisers can improve performance, as well as reduce the costs of mineral supplementation.

### Purpose of work:

The aim of the project was to determine the influence of applying recommended rates of sulphur in grass silage yields and quality. The project objectives were as follows:

1. Assess the effect of sulphur-containing fertiliser application on grass dry matter yields at the farm level (in comparison with N-only fertiliser products)
2. Determine the impact of sulphur application on grass silage quality (in comparison with N-only fertiliser product)

### Approach:

A silage booster fertiliser (20:4.5:14.5+7.5) was trialled on one of the farm's silage fields and its performance compared with a similar fertiliser control that contained no sulphur or selenium (20:10:10). The field's performance was monitored at both first and second cut, with 375kg/ha of fertiliser applied for the first cut, and 310kg/ha applied for the second cut. Yield cuts from quadrants were taken prior to the first cut and sampled were analysed for nutritional quality, as well as sulphur and selenium levels. Bales from each treatment were sampled and analysed for nutritional and mineral content.

### Outcomes:

At the first cut at Bodwi, the silage booster treatment recorded the following:

- ↑ Increased yield (5%)
- ↑ Increase in crude protein content (16.4% vs 13%)
- ↑ Increase in sugar content (9.6% vs 8.2%)
- ↑ Increase in selenium (by five times)
- ↓ Lower metabolisable energy (ME) content

The silage nutritional analysis contradicted the fresh herbage results, with the booster treatment recording higher ME and lower crude protein. Despite this, the selenium levels were 2.4 times higher.

For the second cut, the silage booster recorded lower crude protein and ME levels in the fresh herbage. However, there was an increase in selenium content (from 0 to 0.08) and sugar levels. As with the first cut, the silage analysis contradicted the fresh herbage analysis, with the booster treatment recording higher ME and crude protein; however, the selenium levels were three times higher than the control.

Due to great variability in sward species within the control area in particular, careful attention was given to the fresh samples obtained, to aim for a fair comparison (stratified sampling).

**Other projects taking place on this demonstration site:**

1. **Cost-effective methods of rejuvenating old pasture**
2. **European Innovation Partnership (EIP) project – Early adoption of on-farm 'Internet of Things' (IoT) sensor networks to alert and notify farmers to improve farm security**

# Bryn Farm

## Huw & Meinir Jones

## PROJECT 1: Suckler herd efficiency

### PROJECT FACTS:

- Installing a 100-acre grazing platform has resulted in a saving of £16,875 in fertiliser costs over three years.
- Number of calves born in the first six weeks has risen from 68% in 2019 to 94% in 2022
- Number of calves reared has risen from 88% in 2019 to 94% in 2022

### Background:

Making a margin from suckler cows is never easy, but there are several areas that can usually be improved on. Working out the physical and financial performance of the herd at Bryn Farm provided us with insight and a starting point to draw up an action plan to rectify problems and monitor performance.

### Purpose of work:

1. Improve the profit margin of the suckler herd by monitoring and improving performance
2. Make use of technology to record data, allowing ease of monitoring and evaluation
3. Identify low-performing cows that can be removed from the herd

### Approach:

With around 85 cattle at Bryn Farm, initial historic evaluation was done on the herd's performance and health status. Initial testing was undertaken to assess Johnes status of the farm to ensure that there were no underlining health issues. With the herd testing negative to Johnes and BVD, the focus was on collecting data on performance. Huw and Meinir kept records on cow weight, calving date, calving difficulties and other observations, and regularly weighed the calves. Grass growth was measured every fortnight, allowing for detailed grass budgeting and forecasting any surplus or deficits, which aids in management decisions.

### Outcomes:

- Better grassland management and infrastructure allowed for rotational grazing with no fertiliser requirement to sustain the same kg/DM/ha/day over the three years. This equates to a financial saving of £16,875 in fertiliser costs.

*Table 1. Average daily grass growth throughout the year.*

| Year | 2020 | 2021 | 2022 |
|---|---|---|---|
| kg/DM/ha/day | 34.1 | 27.9 | 28.8 |

- Bryn has improved calving spread year on year, and by 2022, managed to increase the number of cattle calving in the first three weeks by 27%. This gives cows more recovery time and more mating opportunities, within a defined bulling period. A compact calving also allows heifers more time to achieve target bulling weights.

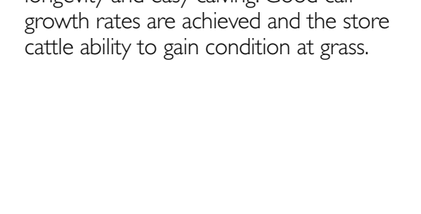


*Figure 4: Percentage of calving per week over four years.*

- Farms that can outwinter cattle are at an advantage; at Bryn, the relatively light ground has allowed the growing of forage brassica crops to keep cows out and only house for 10 weeks during calving. Rotationally grazing cattle of all age classes throughout the year has also been fundamental in reducing costs.
- Ensuring cows are managed according to the appropriate body condition score for the stage of production to optimise use of resources and fertility, and selecting bulls for calving ease has resulted in a rise from 88% to 94% in the number of calves reared. The financial benefit accrued (an extra £96/cow, or £7,200 across the herd) from the increasing number of calves reared and a compact calving is substantial.
- Much of the improvement is down to good management, but this is helped by having a medium-sized maternal cow type – in this case, Salers. The key maternal characteristics are good fertility, early sexual maturity, good fleshing ability, milkiness, longevity and easy calving. Good calf growth rates are achieved and the store cattle ability to gain condition at grass.

**LOCATION:**
**Cardigan**

**FARM:**
**Red Meat**
**101ha in total**
**Cattle outwintered on rape and turnips**
**24ha oats and barley**
**Rotational grazing**
**85 suckler cows, mostly Saler**
**Bulls purchased based on EBV figures. Stabiliser bull has been purchased for 2022 mating**
**Spring calving**
**Solar panels/Holiday lettings**
**Hay grown and packaged for the pet industry**

## FARM OBJECTIVES

1. Reducing cost of production of the suckler herd by improved efficiency
2. Finish cattle, instead of selling as stores to minimise the risk of TB
3. Improve soil health and reduce inputs

"We are very pleased with the performance of the bulls over the three years, and knowing that the bull beef enterprise is a feasible option at Bryn Farm puts us at slight ease, knowing we have a contingency plan if we ever went down with TB."

# Bryn Farm — Huw & Meinir Jones

## PROJECT 2:
Investigating the feasibility of establishing a bull beef enterprise

### PROJECT FACTS:

- On the bull beef ration, bulls were averaging a daily live weight gain of 2.4kg
- Average total value per head at slaughter was £1,311
- Efficient way to produce beef, especially where buildings and home-grown grain are available

### Background:

Being in a high-risk TB area, Bryn Farm wanted to investigate the feasibility of a bull beef finishing enterprise which will help mitigate some of the damaging effects if the herd were to test positive. Previously, they would sell surplus stock as stores, but having an arable operation on-farm lends well to having low-cost feed, compared to buying in, and straw available. With many farm models, cashflow is often concentrated at particular times of the year; establishing a new enterprise at Bryn would generate a new income stream and help spread income across the year.

### Purpose of work:

1. Investigating the feasibility of establishing a bull beef enterprise to minimise the risk of TB
2. Establishing a new enterprise that complements existing enterprises and improving cashflow

### Approach:

At weaning, the top bulls sired by the Charolais bull were identified on daily liveweight gain and kept entire. Huw discussed with a nutritionist the best blend to complement the rolled barley grown on farm; he was advised to feed 70/30 Barley: Blend = 2.33t Barley + 1t Blend Mixed. Bulls were housed and introduced to the Bull Beef ration in January, at around eight months of age. They were given a daily allocation of feed, building gradually to ad-lib fed through a 3-in-1 feeder, with free access to straw and clean water. Bulls were weighed twice a month on average. After reaching a target liveweight of 600kg, bulls were sent to slaughter at ABP.

### Outcomes:

- Daily liveweight gain is a key benchmark of business performance. Over the three years, bulls have averaged a DLWG of 2.4kg, which is very satisfactory.
- For the 52-bull part of this project, the average total value per head was £1,311.
- Labour availability at Bryn Farm is limited, but the daily routine of feeding, bedding and observing bull health took around 45 minutes. Undertaking this daily routine, plus bi-monthly weighing for four months, was very achievable, even with low staffing levels.
- The cost of inputs was less at Bryn Farm, as they could make use of barley and straw from the arable enterprise. Costs in Table 2 reflect the average commercial prices at the time. This is where the integration of the whole farming system at Bryn Farm came together to achieve a successful outcome.

*Table 2: Performance figures of bull beef enterprise over 3 years*

| YEAR | 2020 | 2021 | 2022 |
|---|---|---|---|
| Inputs and costs | Blend 6t @£239/t Rolled Barley 12t @ £130/t Straw £75/t | Blend 9t @ £270/t Rolled Barley 16t @ £184.5/t Straw £105/t | Blend 9t @ £329/t Rolled Barley 18t @ £209/t Straw £70/t |
| Average age at slaughter (months) | 13 | 13 | 14 |
| Av liveweight at slaughter (kg) | 620 | 595 | 604 |
| Av carcass wgt (kg) | 344 | 340 | 345 |
| Av grade | R2 | R3 | R2 |
| (£) Average total value/head | 1,038 | 1,366 | 1,529 |
| Av p/kg | 316 | 401 | 443 |
| Av DLWG on bull beef ration (kg/d) | 2.4 | 2.5 | 2.2 |

### Top tips to apply on your farm:

1. On suckler farms finishing their own bulls, the system is best suited where the herd is achieving a compact calving over a 10–12-week period.
2. A good herd health programme is required for this intensive system, as animals cannot afford any setbacks or store period if they are to achieve the targets set out.
3. Select calves that have performed well pre-weaning, achieving growth of 1.25kg/day or better from birth.

# Cefngwilgy Fawr — Edward & Kate Jones

## PROJECT 1:
Improving homegrown feed value from clovers

### PROJECT FACTS:

- Clover must be present by at least 20% content to have an impact on forage quality
- Clover leys must be carefully managed post-sowing for clover persistence
- 70% of the reseeding costs have been recovered by extra grass production in the establishment year

### Background:

The main aim of the project was to improve the quality of homegrown feed by introducing white and red clover into the grazing and cutting sward. Clovers (white and red) are a good source of protein in ruminant diets, both when grazed or silaged. Clover will also fix nitrogen, therefore less artificial N fertiliser is required for grass growth. Clover-rich swards fit well into forage rotations and benefit soil fertility and structure.

### Purpose of work:

1. To reduce artificial fertiliser input
2. To increase clover content in the reseeded fields to improve forage quality
3. To reduce the amount of purchased concentrates

### Approach:

A total of 11 acres were ploughed and reseeded in May 2020 with six acres of Century seed mix and five acres of Fortress. A six-acre field was ploughed in late April 2020 and seeded with a long-term grazing mixture. One acre of the field had a no-clover mix, 2.5 acres had white clover at 1kg/acre and 2.5 acres had white clover at 2kg/acre. Also, a five-acre field was reseeded with a medium-term grass mixture, four acres of the field included 3kg of red clover and one acre with no clover as a control.

### Outcomes:

- An additional 1,800kgDM/ha grown through the three months on the reseeds.

*Table 3: Mean daily grass growth rates (kgdm/ha/day) and total production for 90 days*

| | Control *(perm pasture)* | Red clover ley | White clover ley |
|---|---|---|---|
| Aug | 34 | 67 | 61 |
| Sept | 20 | 30 | 34 |
| Oct | 12 | 28 | 26 |
| Total kgDM/ha (90 days) | 2,026 | 3,845 | 3,927 |

- This equates to an extra 1,000 ewe grazing days/ha. Over the whole 11 acres of reseeds (4.4ha), that's enough grass to carry an additional 49 ewes.
- With the current value of grass (energy and protein) being over £250/tDM, this means that around 70% of the reseeding costs have been recovered by extra grass production in the establishment year.
- 35% of the sward dry matter was red clover, although the red clover was very patchy across the field.
- The white clover swards were present at only 6% of the dry matter, and there was no difference in sward clover contents resulting from the 1kg or 2kg/acre inclusion. The white clover would not impact significantly on feed value at 6% content or contribute significantly to nitrogen fixation.
- Following overseeding in June 2021, there was a slight improvement in the white clover levels, but the field remains very patchy. Some areas have risen to 30% clover in the sward, but a good part of the field is still below 5%.
- Further soil tests were taken from the high and low-clover areas to see if in-field variation in soil chemistry was influencing the clover success. The areas with the lowest clover had lower P and K levels (P index 1 and K index 2-) compared to P index 2 and K index 3 where clover was strongest. As well as variations in soil chemistry across the fields, there are also differences in soil depth and in exposure/shelter which may also be having impacts on clover survival.

*Figure 5: White clover levels remain patchy despite overseeding*

**LOCATION:**
**Llanidloes**

**FARM:**
**Red Meat**
**200ha in total**
**50 Limousin-cross and British Blue-cross suckler cows**
**1,000 ewes, mostly Texel-cross, Aberfield-cross and Mule ewes and some Speckled Face ewes**
**Spring calving with 1/5 calving in the autumn**
**Main flock lambs Indoor - March**
**Speckled face lamb outdoors from mid to end of March**
**60kW biomass boiler**
**4kW solar system**

## FARM OBJECTIVES

1. Gaining a better understanding of the farm's soils and improving forage quality
2. Reduce the amount of inputs used on farm, mainly concentrates and fertiliser
3. Making decisions based on data

"The tags have been picking up some cases, but whether they are financially viable or not for a commercial beef herd like ours is a hard one to work out. If you had a pedigree herd, something high-end, the system could be worth looking into. I think the technology has the potential as it develops further, though."

# Cefngwilgy Fawr — Edward & Kate Jones

## PROJECT 2:
Improving herd health through the use of technology

**PROJECT FACTS:**

- A monitoring system has been shown to detect disease approximately two days prior to the appearance of clinical signs.
- Enables targeted antibiotic usage and reduces calf mortality, as disease is detected early – pneumonia can cost up to £82 per affected suckler calf, with costs rising significantly when subsequent treatments are required.
- Further developments are needed in order for the monitoring system to be used effectively outdoors for suckler herds.

**Background:**

Following cases of pneumonia in their calves in past years, calf health was a priority. Mycoplasma bovis was first diagnosed as the cause of pneumonia three years ago, and cases have since peaked at 25%.

Pneumonia is caused by a range of factors, which include:

- Infectious pathogens
- Housing environment
- Calf management
- Immune status of calves

**Purpose of work:**

1. To improve calf health and performance
2. To identify disease early on through data and apply interventions where necessary
3. To reduce the use of antibiotics

**Approach:**

Monitoring technologies have been used with great success at many farms where they have been used indoors, mainly for dairy herds. In April 2021, an ear tag from Cambridge Animal Technologies Limited (known as Smartbell®), which measures calf activity and temperature, was placed in the calves' ears to monitor their health. A gateway was used to collect and transmit data; this was sent to Smartbell servers, where the data was analysed and findings shared with the farm.

**Outcomes**:

During 2021, the system picked up two calves that needed attention:

1. An urgent alert was sent on one calf that showed a drop in ear temperature on 15 June 2021. Following assessment and closer observation, the calf was treated for coccidiosis. The issue would not have been spotted visually without the alert being sent.
2. A heifer was highlighted by the system as having reduced activity. The heifer was monitored, and two days later presented with frothing of the mouth. The vet was called to assess and the animal was treated.

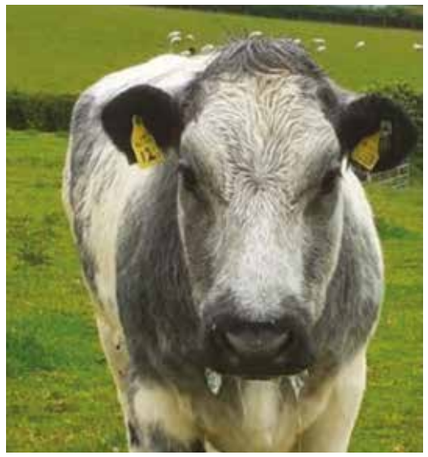


*Figure 6: Heifer frothing from the mouth*

Unfortunately, this monitoring system was not suited to the beef enterprise at Cefngwilgy. Although the system did pick up on anomalies within the calves, there were also some false readings, where an alert was sent to the farmer, but the calves were well and had no issues. When used outdoors, the tags would often go out of range from the receiver, which may explain some of the false alarms. This is an unavoidable issue for Cefngwilgy, but would work better for farms that rotationally graze and could move the receiver with the herd.

Many of the tags were also damaged in the calves' ears over the summer period. The tag design was highlighted, and a modification was made to reinforce the design to be more robust.

When the project started, the battery life for the tags was a maximum of six months; however, a software update will extend this to 12 months, which would be very useful for practical use.



# Cefnllan — Neil Davies

## PROJECT 1:
Comparing various reseeding methods

**PROJECT FACTS:**

- The ploughed section considerably out-performed.
- Reseeding through ploughing is more expensive than direct drilling, but this cost can be recouped through enhanced feed value in the reseed.

**Background:**

A common question asked by many farmers who decide to reseed is, "What is the best method of reseeding to establish a good grass-clover sward?"

Over recent years, Cefnllan has embarked on an extensive reseeding programme, where 20 hectares are reseeded annually. These new leys are very productive in the spring, when the business needs to make the most of its grass. Identifying the best and most cost-effective method of reseeding would be a great benefit for the business.

**Purpose of work:**

Compare various methods of reseeding, along with the most cost effective.

**Approach:**

One field (12 acres) was part-ploughed and the remainder direct-drilled with different machines, with some areas sprayed off with glyphosate on 26 August 2020 and others not – as seen below in Figure 7. On 10 September 2020, three out of the four plots were sown. The fourth plot was sown on 17 September 2020. Establishment counts were carried out in December 2020 and in May 2021, by taking five cores from each plot, with the plant species teased out of each core for counting and identification. The soils were analysed for each treatment. In April 2021, the field was grazed and then closed for silage.

| | Not-sprayed | Not-sprayed | Not-sprayed |
|---|---|---|---|
| | Sprayed | Sprayed | Sprayed |

| PLOT 1 | PLOT 2 | PLOT 3 | PLOT 4 |
|---|---|---|---|
| Plough and cultivate | Aitchison T-Slot Drill | HE-VA Multiseeder | ERTH Disc Seeder |

*Figure 7: Layout of the trial plots in the field*

**Outcomes**:

During the visit to take cores in December, the over-riding weed species was buttercup (Ranunculus), and this was present across all treatments, as glyphosate does not kill buttercup. The most common weed after buttercup in the sprayed and cultivated areas was chickweed (Stellaria). The unsprayed areas had a large presence of moss and occasional daisy, sheep's sorrel and cat's ear.

The clover was present across all treatments; the majority was already established clover, rather than new, but it was looking well and active. The increase in weed species on the sprayed areas was quite significant, with them impacting on competition for light, space and nutrients.

Although the ploughed reseed was carried out later than the drilling, the plots had good growth, and the weed burden and old indigenous grass percentage was less. The ryegrass percentage – of which a vast majority was new seed – developed well, which meant that the nutritional value of every bite would be better for stock performance.

*Table 4: Percentage of ryegrass at visits*

| Ryegrass % of sward | December 2020 | May 2021 |
|---|---|---|
| Plough | 81 | 81 |
| Spray 1 | 18 | 28 |
| Spray 2 | 54 | 73 |
| Spray 3 | 63 | 60 |
| Not sprayed 1 | 33 | 47 |
| Not sprayed 2 | 94 | 49 |
| Not sprayed 3 | 64 | 69 |

**How to apply on your farm:**

- ☑ Conduct a nutrient management plan, as this can determine soil health and fertility
- ☑ Consider which seed mixes to use, and which ones will benefit the system most
- ☑ Consider what machinery you have available
- ☑ Consider conditions such as weather when preparing fields for sowing

**LOCATION:**
Llangammarch Wells

**FARM:**
Red Meat
105ha in total
5ha woodland
30ha root crops
20ha barley
Growing and finishing 150 cattle annually
2,000 Epynt Hardy Speckled flock, sired to Epynt Hardy Speckled or Texel rams
Lambing February to April
Rotational grazing
Glastir

## FARM OBJECTIVES

1. Increase annual grass yield by 33% and utilisation by 38%
2. Increase net production (kg of beef produced per hectare) by 50%
3. Increase liveweight gain to 1kg/day at grass

"Since we started as a demonstration site, we have been lucky to work with experts, and this work has made a big difference to be able to see how much food we have available, as before I could work out how much silage was in the clamp, how many bales I had, or how much feed was in the bin, but it was difficult to know how much grass I had and its quality. Grass measuring has definitely made a big difference."

# Cefnllan — Neil Davies

## PROJECT 2:
Managing the change; sucklers to dairy beef

**PROJECT FACTS:**

- Increasing grass growth from 3tDM/ha in 2019 to 9tDM/hectare in 2021
- During turnout months, older cattle achieved an average daily liveweight gain of 1kg/day off grass

**Background:**

Dairy-beef production offers farmers a flexible means of producing beef, with a variety of possible finishing systems that can be adapted according to the type of farm, and the available on-farm resources. Making maximum use of grazed grass in the diet of cattle is essential to the protection of margins in beef production.

**Purpose of work:**

Investigate the feasibility of changing from a traditional suckler cow enterprise to rearing, growing and finishing bought-in Angus-cross dairy calves on a low-cost and forage-based system.

**Approach:**

A rotational grazing system was designed through mapping fields and drawing up a grazing plan. In April 2020, 100, three-to-four-month-old Angus-cross Holstein x Friesian calves (140kg average weight) were rotationally grazed. Neil measured farm grass cover fortnightly using a plate meter. Using FARMAX, Farm IT and Agrinet supported Neil with key management decisions, such as taking fields out for silage and stock numbers, and allowed for the recording of important data, such as calves' weights, linked to their EID tags. A weather station was also recording air temperature, soil temperature and rainfall data.

Finishing calves' ration and growing calves' ration were produced by Hefin Richards from Rumenation and the silage was analysed ahead of winter. Neil had installed slats into an existing shed on the farm and the calves were housed in December 2020.

**Outcomes**:

The improved grassland management resulted in better control of field covers. When the fields were closed off for livestock in November 2020, the farm cover was averaging 2,024kgDM/ha, compared to an average of 1,589kgDM/ha in November 2019, putting the farm in a much better position at spring turnout.

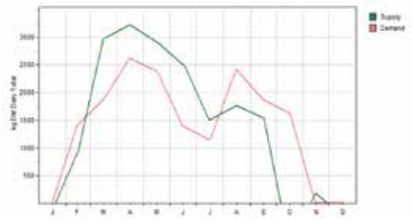


*Figure 8a: Estimated supply of grass under the original grass management regime*

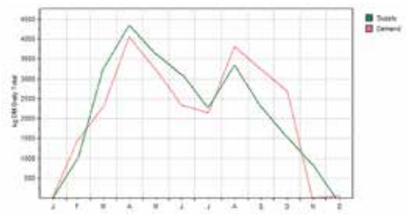


*Figure 8b: Estimated supply of grass under the rotational grazing management*

The calves were weighed on a monthly basis, and in August 2020, the seven-to-eight-month-old calves were weighing an average of 245kg. The calves were housed in December, and their average weight in January was 410kg, meaning an average DLWG of 1.5kg since housing.

Once fattened, the cattle were sent to slaughter with the finished cattle averaging 21 months, with anything not ready then sold as stores to make room for the new batch of calves that arrived at the farm in May 2021. The same system will be adopted for this new group of calves.

**How to apply on your farm:**

- ☑ Consider rotational grazing; map out your farm to see if any fields can be split
- ☑ Measure farm cover frequently using a plate meter, to see the availability of grass
- ☑ Analyse your silage to know its nutritional values and quality
- ☑ Analyse what you are feeding livestock
- ☑ Buy in strong, healthy calves
- ☑ Regular weighing of calves to monitor performance and to work out DLWG
- ☑ Use EID tags in calves to monitor easily

# Dolygarn — James Powell

## PROJECT 1: Alternative forage options to improve productivity and reduce environmental impact on an upland farm

**PROJECT FACTS:**

- Income from land growing a winter grazing crop of a rape, ryegrass and berseem clover mixture has doubled compared to brassicas
- Eliminated soil run-off from bare fields over winter
- Growing a crop of Clampsaver doubled income from lamb sales:
  - 7,843kg of lamb on 4.7ha returning £16,845 in sales
  - compared to 3,500kg of lamb worth £7,500 from the brassicas.

**Background:**

There is an increasing pressure for farmers to reduce production costs, as well as pressures to reduce their impact on the environment. The grazing pressure on in-bye land on an upland/hill farm in the spring is high, and losing access to a productive field at this time due to bare soil following the brassica crop causes a real bottleneck, and is a cost to the business.

**Purpose of work:**

The aim of this project was to investigate alternative wintering crop in comparison to the conventional brassica (stubble turnip or swedes) system, to mitigate against risk of soil and nutrient loss and impact on water quality and future farm productivity.

**Approach:**

At the start of June 2020, 10.8 acres of Brassica Express and 14 acres of Clampsaver were sown on adjacent fields that had been sprayed off. The fields received manure, and were rolled well to capture the moisture content, as the ground was very dry. There was an outbreak of flea beetle, which was identified early and sprayed. Soil and nutrient run-off were monitored. The crops were partitioned into grazing blocks to improve the utilisation. On 1 November 2020, 215 lambs were placed on each crop until 23 December 2020. Lambs were weighed and finished off the crops in batches during this seven-and-a-half-week period. By this time, there were four acres of Brassica Express remaining and two acres of Clampsaver, plus the regrowth over the whole area.

**Outcomes**:

- Both crops yielded well, with the Clampsaver having an average yield of 4.5-5tDM/ha, and the Brassica Express having an average yield of 6-6.5tDM/ha, with no artificial fertiliser used.
- Actual establishment costs worked out the same (both fields were sprayed-off, disced, power harrowed, drilled, rolled etc.); seed price was different (a difference of £35/acre).
- Root assessment highlighted that the Clampsaver crop had roots reaching down to 11 inches in comparison to 6.5 inches for the Brassica express crop. In addition, twice as many worms were counted in the Clampsaver field.
- Clampsaver will mitigate the risk of soil and nutrient loss when compared to the Brassica Express, and a grass-based crop will have the ability to anchor the soil.
- There was no significant difference between the liveweights of the fat lambs or killing-out data. However, there was a major difference between the number of lambs finished from both crops, with 184 finished from the Clampsaver, compared to 81 on the Brassica Express during the same timeframe. The remaining 120 lambs that were on the Brassica Express were creep fed to finish, which resulted in extra feed cost.

"It has allowed us to graze it in the back end of the year, lamb on it in the spring, and then get the value of silage from it. Nature has never had bare soil; we are going with nature, having more roots in the ground and more biodiversity."

**How to apply on your farm:**

- ☑ Consider which crops suit your farm best
- ☑ Consider which fields pose the greatest risk of soil run-off. Consider which crop to plant to reduce the risk of this
- ☑ Good preparation of field/soil before and after planting gives the crop the best opportunity to establish
- ☑ To improve utilisation of crop, partition the field into blocks
- ☑ Weigh lambs regularly to monitor performance

**LOCATION:**
**Llandrindod Wells**

**FARM:**
Red Meat
190ha in total
20ha woodland
1,000 sheep
(Aberfield and Welsh)
30 suckler cows
(Saler and Aberdeen Angus)
Rotational grazing
Lambing in April
Calving in May
B&B pig unit
Holiday lettings
Biomass boiler
Solar panels

## FARM OBJECTIVES

1. Improve soil health
2. Reduce inputs by growing diverse species
3. Subdivision of grazing structure to maximise the utilisation of grass

# Erw Fawr

Ceredig & Sara Evans

**LOCATION:**
**Holyhead**

**FARM:**
Dairy
192ha in total
300 Holstein cows
250 heifers
Rotational grazing
All-year-round calving
Use of artificial intelligence to reduce lameness
Sensor technology to assist nutrient management

## FARM OBJECTIVES

1. Increase yield from forage
2. Reduce lameness levels
3. Improve grass measuring and allocation

## PROJECT 1:
Use of artificial intelligence to reduce lameness

**PROJECT FACTS:**

- Lameness was reduced by 50% through using an AI software, CattleEye
- ROMS accredited mobility scorers agreed, with 93% of AI scores provided through CattleEye
- $CO_2$ emissions were reduced by 0.5 tonne per cow through increased efficiencies directly associated with lameness

**Background:**

Currently, it is estimated that 30% of the UK's dairy herd is lame at any one time, ranging from score 2-3, costing an average £2.20/cow/day (AHDB, 2019). A reliable method to score cows regularly and accurately is needed to identify lame cows early, and treat them before the issue becomes more serious. Video analytics technology has created an opportunity for the dairy industry to harness the benefits of a deep learning-based video analytics platform to more efficiently manage livestock and provide consistent evidence of animal welfare standards.

**Purpose of work:**

1. Reduce lameness levels
2. Automate the mobility scoring and list-creation of lame cows to treat
3. Reducing the financial implications of lameness on a dairy herd's bottom line.

**Approach:**

CattleEye has developed a deep learning cloud-based artificial intelligence platform, designed to interpret visual imagery of livestock from industry standard CCTV web cameras. It autonomously identifies cows exiting the milking parlour from their biometrics and markings, and registers daily mobility scores. These were then fed directly to the farmer, allowing them to take appropriate action.

*Figure 9: CattleEye recognising and assessing lameness*

Prior to the start of the project, monthly visits by foot trimmers were conducted, but this was increased to twice a month, to make better use of the information provided by CattleEye and University of Liverpool. The project hoped to deliver substantially raised welfare standards through tracking and reducing lameness levels, addressing a fundamental social and consumer demand.

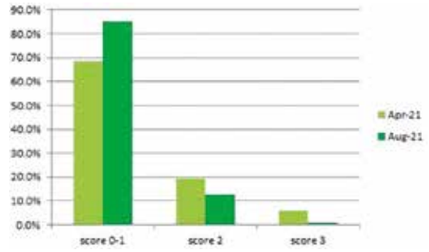



*Figure 10: Mobility scores at the start and at the end of the CattleEye project*

**Outcomes**:

At the start of the trial, cows were scored by human eye, using the AHDB scoring system; 25.4% had mobility issues, with 5.9% at score 3, indicating severely impaired mobility. All validation mobility scoring throughout the project was conducted by the same person.

Six months later, and only 1% of the herd was at score 3; across the herd, mobility issues (cows with a mobility score of 2 or 3) had reduced from 25.4% to 13.5%.

**How to apply on your farm:**

- ☑ Assess current lameness levels on your farm with an Register of Mobility Scorers (RoMS)-approved scorer
- ☑ Draft and pick up cows' feet at the earliest opportunity when any upward score changes occur
- ☑ Regular foot-bathing for overall health
- ☑ Consider a routine herd trim 60 days after calving and before drying off
- ☑ When treating lame cows, keep records to work out potential causes
- ☑ Address any slippery concrete areas, unscraped areas, tight turns, poor cow tracks and assess cubicle comfort and the number of cows per cubicle
- ☑ Assess if an automated system can help your situation *(estimated £1/cow/month)*



# Forest Coalpit Farm

Kyle Holford & Lauren Smith

**LOCATION:**
**Abergavenny**

**FARM:**
Pigs
10ha in total
3ha woodland
25 sows
250 finishers, Welsh black (Duroc x Large Black)
Rotational grazing
Direct meat sales
Farming Connect mentors
Farm tours
Free range grass-based pigs

## FARM OBJECTIVES

1. Improve pig welfare
2. Focusing on improving flavour and meat quality
3. Reduce environmental impact

## PROJECT 1: What effect do different diets have on pork quality?*
**Joint project with Menter Moch Cymru*

**PROJECT FACTS:**

- The omega-3 essential fatty acid, a-Linolenic acid (ALA), was most affected by the addition of forage

**Background:**

With an increase in farmers selling their produce directly to the consumer, it is fundamental that the quality of the product sold is of the highest standard. The project looked to address the increasing desire from consumers to see quality and traceability in products, with an increasing emphasis on more sustainable production methods.

**Purpose of work:**

To establish if a forage-based system has a significant impact on pork quality, and in particular, the fatty acid profile.

**Approach:**

Only gilts were used for the trial, to ensure sex did not affect the dataset. Pigs were allocated to a treatment group at random:


Both treatment groups were supplemented with 2kg per head per day of concentrate being made available to encourage the pigs to eat the forage.

Over the period of the trial, the animals were given two different feed rations:

**Feed 1** – Grower Spec
**Feed 2** – Finisher Spec

The switch from Grower to Finisher ration took place on day 120.

*Figure 11: Group 2 pigs in a forage paddock*

Once the average liveweight of both treatment groups was approximately 93kg, the pigs were taken to slaughter. Following slaughter, half a loin from each individual pig was sent for analysis.

Working in conjunction with Caroline Mitchell from FQM Global and the Food Technology Centre in Llangefni, the assessments that were undertaken included:

- Warner Bratzler shear force
- EZ-Drip loss
- CEILAB colour scoring
- NPPC (USDA) colour and marbling score
- NIR assessment (which will provide a fat, protein and moisture content, amongst other values).

**Outcomes**:

- Linolenic acid was the fatty acid most affected by the addition of forage. Often referred to as a-Linolenic acid (ALA), it is an n-3 or omega-3 essential fatty acid.
- a-Linolenic acid can only be obtained by humans through their diets, because the absence of the required 12- and 15-desaturase enzymes makes de novo synthesis from stearic acid impossible. Pigs are also unable to synthesise ALA, and therefore the significant difference between treatment groups is a direct result of the addition of forage to the diet.
- The sample size was relatively small, at 10 versus nine animals. To draw further conclusions as to the effect of forage on meat quality, a larger dataset would be required.

**Kyle's top tips for an outdoor-based pig system:**

- ☑ Choose the right location; think about land/soil type, is there shade in summer? Not too wet in winter, etc.
- ☑ Choose the right breed that will fit your outdoor system
- ☑ Think about access to feed and straw-up your pigs in winter
- ☑ Correct housing infrastructure for the number and size of pigs; think cool in summer, and warm in winter
- ☑ Have a plan for loading out your pigs with access for a trailer

## Glanmynys

Carine Kidd & Peredur Owen
*(Share farming partnership)*

**LOCATION:**
**Llandovery**

**FARM:**
**Red Meat**
**215ha in total**
**31ha woodland**
**6ha swedes for outwintering**
**Rotational grazing**
**950 breeding ewes**
**300 ewe lambs**
**Mixture of EasyCares, Aberfields and Welsh breeds**
**Outdoor lambing from April**
**Contract rearing 250 Angus and Wagyu cattle**

## FARM OBJECTIVES

1. To maximise average farm grass covers through measuring and monitoring
2. Monitor flock performance and identify KPIs
3. Insight into trace element status



# PROJECT 1:
## Getting a handle on flock performance

### PROJECT FACTS:

- Transition to pasture focus resulted in a saving of £1,694 in concentrate feed costs
- Monitoring ewes and managing body condition score resulted in a 6.4% reduction in barren or aborted ewes
- Profit margin per ewe increased by £3.34

### Background:

When the share farming partnership between Carine Kidd (the farm owner) and Peredur Owen commenced, many changes were implemented. Within the flock, these changes included breed, transition to outdoor lambing, focus on forage and winter crops, to name a few. Monitoring flock performance was essential amidst these management changes.

### Purpose of work:

1. Identify Key Performance Indicators to monitor flock performance, ensuring management changes are positive – allowing for year-on-year benchmarking.
2. Input data into FARMAX – an advanced grazing software program to aid with decision-making.

### Approach:

To monitor the impact of the changes and to ensure flock performance is on track, data is collected to monitor and a set of performance indicators are identified to set targets for the flock. A data capture form was created to input data at key times of the year; physical and financial figures were captured every year, allowing for benchmarking and identifying strengths and weaknesses.

- Regular grass measuring was undertaken to help prepare grass budgets through the season.
- Routine meetings were instigated, to allow for discussions and decision-making between all involved.

### Outcomes:

- A move to a forage-based system has reduced feed costs by £1.52/ewe, and introducing swedes as an outwintering crop has begun a reseeding programme, further improving grassland quality.
- The flock has seen a 9% increase in scanning percentage, as a result of improved nutrition and achieving target body condition scores.
- The expenditure on vet and meds has doubled, as the result of more investigatory work (such as metabolic profiling and blood samples to evaluate trace element levels).
- Due to improved efficiency and a shift towards a low-input forage-based system, the profit margin per ewe has increased from £6.31 to £9.65.

*Table 5: Flock data collection*
*Data for 2021-22 will be available at the end of 2022*

| | 2019-20 | 2020-21 |
|---|---|---|
| Ewes put to the tup | 1,037 | 1,100 |
| Ewes barren or aborted (%) | 10.5 | 4.1 |
| Lamb sales - finished | £83.64/head | £88.37/head |
| Concentrates fed | £1.69/ewe | £0.15/ewe |
| Vet and meds | £6.99/ewe | £12.15/ewe |
| Av. carcass weight (kg) | 18.34 | 16.8 |
| Profit margin £/ewe | £6.31 | £9.65 (£3.34 diff) |
| Scanning % | 141 | 148 |
| Rearing % | 117 | 128 |
| Lamb losses | 251 (17%) | 218 (13%) |

### Lessons learnt at Glanmynys:

1. Have a system that suits your strengths, in terms of the farm, climate and staff
2. Identify Key Performance Indicators for your flock to monitor
3. Know your soil health. Soil test regularly, assess soil fertility and health
4. Grow and utilise more grass at home by adopting rotational grazing
5. Use forage brassicas as break crops to reduce winter costs and act as break crops for reseeding policy
6. Identify the farm's carrying capacity; buying in inputs can be a drain on your system in the long term
7. Use faecal egg counts to assess wormer efficacy and gauge whether you need to dose
8. Use blood tests to identify nutritional deficits or trace element issues
9. Never underestimate body condition-scoring ewes at key times – pre-tupping, scanning and weaning
10. Use teasers to condense your lambing period

Glanmynys

Carine Kidd & Peredur Owen
*(Share farming partnership)*

# PROJECT 2:
## Establishing trace element status

### PROJECT FACTS:

Blood sampling to monitor for trace elements can save money from unnecessarily gathering sheep to administer supplements, or by choosing a supplement that provides beneficial trace elements from the wealth of products available.

### Background:

Glanmynys has had an historic issue with trace element deficiencies. However, with a change in farm management which led to the adoption of rotational grazing and a change in sheep breed, work was undertaken to investigate the current trace element status on the farm.

### Purpose of work:

Assess possible mineral imbalances with macro and micro minerals in the sheep and cattle enterprises.

### Approach:

Establish mineral levels in the grazing platform by collecting fresh grass and silage samples. Blood samples were taken for a representative group of cattle and analysed for biochemistry and trace element status. A data review was undertaken of historical tests to provide a long-term picture and act as a comparison.

Data collection was undertaken to capture information on fertiliser rate, farmyard manure (FYM) application, grazing management and mineral in-put over the last year. An in-depth soil sample was also conducted providing data such as soil trace elements, cation figures, and soil biology.

### Outcomes:

- Biochemistry reports suggest that possible nutritional parameters are not being met, or protein is being over-supplied and causing an imbalance with the energy supply, which could result in sheep losing body condition.
- The results from the grazing platforms indicated that potassium could become aggressive in diets fed to pre-lambing stock, putting them at risk of milk fever or twin lamb disease.
- Increased potassium levels may also put cattle at risk of grass staggers and milk fever pre-calving.
- Sodium levels have been reported as low in the mineral sample taken from the grazing platform; an application of agricultural salt would help to improve grass palatability, which should help improve dry matter intake (please take advice on applications of salt to grazing land before applying).
- We have concluded that molybdenum and sulphur is possibly forming thiomolybdate. This condition could impact on energy utilisation, fertility and immune function.
- Overall, selenium, iodine and cobalt supplementation needs to be reviewed and new approaches undertaken.

### How to apply on your farm:

- ☑ Address the basics, animal health, body condition, feed intake and water access and quality
- ☑ Deficiencies of trace elements can cause poor production, but there are other common causes of low productivity – such as parasites or energy deficiency
- ☑ If investigating mineral problems on livestock farms, always start with forage mineral reports – these need careful interpretation
- ☑ Evaluate all mineral supplements supplied to stock within the last year
- ☑ Make sure that the laboratory being used for testing can test for all elements that affect livestock production
- ☑ Establish clinical conditions in tandem with forage mineral reports

**"Undertaking this work has been very beneficial and [gives] a fantastic insight into the current status of the farm.**

**We will continue to monitor trace elements and respond with the correct supplementation."**

# Graig Olway Russell Morgan & family

Graig Olway Russell Morgan & family

**LOCATION:**
**Llangeview**

**FARM:**
Dairy and Arable
240ha in total
40ha maize
61ha wheat
22ha barley, 6ha oats
114ha grassland
170 high-yielding Holsteins
All-year-round calving
Strip grazing
4 milking robots

## FARM OBJECTIVES

1. Improve foot health and herd mobility
2. Improve infrastructure

## PROJECT 1:
Focus on feet: reducing lameness in a robotic milking dairy herd

**PROJECT FACTS:**

- Reduction in sole ulcers from 24 cases/100 cows/year to less than one case/100 cows/year
- Lameness reduction from 39% (with a high of 50%) to <15% resulting in a cost saving of >£30,000/year

**Background:**

Reducing lameness levels and improving cow comfort were identified as two of the key goals for improving herd welfare and increasing milk yield. Due to the voluntary milking system, lame cows are likely to visit the robot on fewer occasions than healthy cows, and therefore the impact that lameness will be having within the herd will be greater. It was calculated that lameness at Graig Olway was resulting in economic losses of £138/day.

**Purpose of work:**

1. Implement the AHDB Healthy Feet Programme and assess the impact of key recommendations on lameness and mobility implemented within the herd
2. Determine the effect of implementing a targeted lameness control programme on the lameness levels of the herd and calculate the short-term cost-benefit of implementing

**Approach:**

All cattle were scored for mobility and digital dermatitis (DD) at the beginning of January 2020. Following scoring, all cattle with signs of DD went through a 'blitz' treatment, which used licensed topical antibiotic treatment. The cows were re-examined for two consecutive days, and repeat treatments given where necessary. Following the initial 'blitz' treatment, all cattle were mobility scored quarterly to monitor their progress. Russell decided to increase to fortnightly mobility scoring for increased sensitivity and early detection. A mobility management timetable and action plan was created to ensure that all aspects of lameness management became part of the normal farm routine.

**Outcomes**:

- During the baseline visit in January 2020, Sara Pedersen scored the herd as 39% lame (Score 2 or 3 on the AHDB scoring system), with 39% of the herd also having at least one digital dermatitis lesion.
- Figure 12 highlights the downward trend in lameness scores over the last two and a half years.
- A combination of factors saw lameness increase early in the project – at which point, the foot trimmer was changed and visit frequency increased towards the end of the first year. Not only did the overall levels of lameness decrease, but the severity of the lesions seen also reduced.

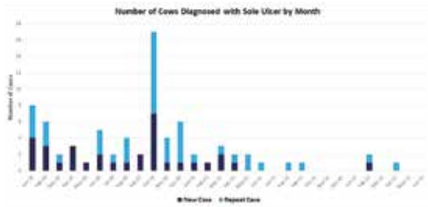



*Figure 12: Number of cows diagnosed with a sole ulcer by month*

- The fortnightly mobility scoring allowed for earlier detection, and therefore earlier treatment – resulting in fewer chronically lame cows. Best practice treatment protocols for early cases of lameness were also implemented; this included use of non-steroidal anti-inflammatory drugs (NSAIDs). Higher recovery rates following NSAID treatment and fewer repeat cases of lameness contributed significantly to the reduced number of new chronic cases.
- Sole ulcers were the main lesions identified through trimming records. In 2019, 36 cows were recorded with sole ulcers, of which most were chronic or repeat cases. From improving cow comfort and reducing pressure points around the housing and management yards, sole ulcer cases have reduced to only 12 in 2021, and three so far in 2022 – of which only one was a new case: a cow with a history of other lesions causing lameness. In May 2022, sole bruising lesions increased in the heifer side of the shed; this was due to overstocking of the robots.

## PROJECT 2:
Technical considerations when improving infrastructure

**PROJECT FACTS:**

- 6,500m³ lined earth-bank lagoon aids business growth, allowing expanding the herd and installing another robotic milking machine
- Can target manure applications to crop nutrient requirements; reducing fertiliser costs
- Taken into account slurry from all livestock, but also the volume of lightly fouled water, such as silage clamp run-off, parlour washings and slurry from open feeding yards

**Background:**

Russell was aiming to increase the herd to around 250 head and to install another robot. One of the main barriers identified was the capacity of the slurry lagoon, which wouldn't hold the excess slurry. Having adequate and well-maintained on-farm slurry storage with the capacity to hold six months' worth of slurry will enable farmers to target natural manure applications to match with crop nutrient requirements, rather than when storage reaches its limit. By focusing on application to crop growth needs, nitrogen intake can be increased and dependence on artificial fertiliser diminished.

**Purpose of work:**

1. Investigate the options and measures to take into account when increasing slurry storage capacity.
2. Give an insight into the process of increasing slurry storage capacity, from water management to location suitability.

**Approach:**

A full farm visit allowed a consultant to explore how best to achieve improved slurry storage capacity, specifically focusing on:

- reducing clean water run-off into slurry storage
- site selection considerations
- meeting planning and building warrant regulations
- most suitable storage solutions

During the site visit, trial pits were dug at the perimeter points of the proposed lagoon area and the centre of the site. The results highlighted a need for the lagoon to be fully lined and for a leak detection system to be built in.

**Outcomes**:

The plan has been designed to hold slurry capacity for 300 dairy cows, and 200 youngstock/heifers, with a total storage requirement of 6,413m³; in comparison, increasing the capacity provided by the current slurry lagoon by 85%. Storage capacity takes into account:

1. Lightly fouled water – silage clamp run-off
2. Slurry from all livestock
3. Parlour washings
4. Slurry from open feeding yards

A slurry lagoon with a capacity of 6,500m³ will require an excavation 45m wide x 60m long x 5.2m deep, overall depth to top inside of the proposed bank, with an internal bank slope of 1.5:1. The lagoon capacity takes into account the rainfall and freeboard requirement. All lined earth-banked lagoons require a freeboard of 750mm, plus the ability to contain any surface rainfall, which would be a minimum of 632mm for the five-month storage requirement. Given the shallow soil and high stone content of the proposed lagoon location, a leak detection system was recommended (Figure 13). Russell also wanted a long and gradual slope at the far end of the lagoon, which meant the area could still be used for grazing without losing the whole field. It will also ensure better compaction as the soil would be compacted downwards, rather than down the slope.

*Figure 13: Leak detection system installed*

"We would have struggled to make these changes without the great advice received from Sara Pedersen and Eoin Murphy as part of the demonstration network. They've had a big impact on not only the herd's health, but also on the business. Cows look much more content in the shed, and we will be carrying on with the lameness management routine: mobility scoring and foot trimming fortnightly, along with strict foot-bathing."

# Halghton Hall

David Lewis

LOCATION:
Wrexham

FARM:
Red Meat and Arable
202ha in total
31ha cereals
12ha stubble turnips
275 continental cattle finished annually
1,100 ewes (Aberfield X and Welsh Mules)
Lambing - February to April
Glastir
Biomass boiler
Solar PV panels

## FARM OBJECTIVES

1. To undertake a full carbon audit of the system to determine the baseline for the present farming system
2. Increase the number of ewe lambs in lamb and conception rates by looking at ewe lamb liveweights and use of teaser rams to stimulate oestrus
3. Compare the performance of ewe lambs on stubble turnips and grass following conception, to determine benefits of stubble turnips on the system practised

## PROJECT 1: Best practice management for ewe lambs as they rear for the first time and are introduced into the main flock

### PROJECT FACTS:

- Scanning results indicated that 57% of the ewe lambs were in-lamb in Year 1 after being given one oestrus cycle only
- Heavier ewe lambs (>45 kg) pre-tupping achieved a conception rate of 76% in comparison with 49% of the ewe lambs weighing between 42 and 46kg pre-tupping in Year 1 following one oestrus cycle with the ram

### Background:

Successfully lambing ewe lambs can be challenging, due to their general lower fertility and prolificacy rates than adult ewes, as a result of decreased ovulation rates and increased embryo mortality. However, there is potential to improve their reproductive performance, and therefore the flock efficiency, via husbandry and nutrition alternations. Body weight at mating and lambing are critical to the survival and wellbeing of both the ewe lamb and her lambs.

### Purpose of work:

1. To determine the best management practices for ewe lambs as they rear for the first time and are introduced into the main flock
2. To explore the optimum conception weight and condition for an ewe lamb on-farm

### Approach:

For the first year of the study, just under 300 ewe lambs were purchased in 2019, and were weighed prior to mating. The ewe lambs were then divided into three groups based on their weights –1) < 41kg, 2) 41-45kg, and 3) > 45kg. They were mated from the end of October, with scanning and lambing performance assessed on an individual basis. In doing so, the optimum weight and condition for ewe lambs at tupping and lambing was explored.

### Outcomes:

The rams only ran with the ewe lambs for one cycle at tupping in Year 1, which resulted in overall scanning and conception percentages of 71% and 57% respectively. Results from the first year indicated that weight at tupping can influence conception rates, with heavier ewe lambs achieving the highest scanning and conception percentage from the weight groups.

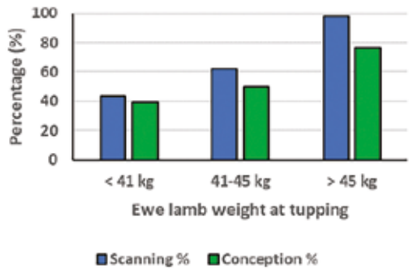



*Figure 14: Ewe lamb scanning and conception percentages*

The ewe lambs performed remarkably well at lambing, at an average weight of 58kg. There were very few issues, and the lambs achieved a daily liveweight gain (DLWG) of over 0.4kg within the first 40 days post-birth. Data from the first year will be used as a benchmark for the next breeding programme.

In Year 2, the ewe lambs were given two full cycles with the ram, which resulted in a scanning percentage of 86%.

### How to apply on your farm:

- ☑ Ewe lambs need to be >60% of mature weight at mating, and grow at about 130g/day from six weeks post-mating
- ☑ Shearlings should be 80% of mature weight at mating
- ☑ When selecting replacements from home-bred ewe lambs, select those that are physically sound, in terms of feet and teeth
- ☑ A ram-to-ewe lamb ratio of 1:25 or 1:35 is recommended for synchronised or unsynchronised oestrus
- ☑ Mate ewe lambs separately from mature ewes, because their oestrus behaviour is less aggressive
- ☑ Use experienced rams
- ☑ Mate ewe lambs on small areas of land
- ☑ Manage as a separate group throughout the year
- ☑ It is advised to let an ewe lamb rear only one lamb
- ☑ Wean lambs early (9-12 weeks)



# Henbant Farm

Matt Swarbrick

LOCATION:
Caernarfon

FARM:
Horticulture
31ha in total
1,000m² Market garden
30 x day-sized grazing pastures over 20 acres divided by tree lanes
Silvopasture
Regenerative agriculture
Agroecology
Biodiversity
No-dig method

## FARM OBJECTIVES

1. Increasing financial profitability and resilience
2. Enriching ecosystems and improving soil health and biodiversity
3. Building social capital and community engagement

## PROJECT 1: Establishing an agroforestry and regenerative agriculture scheme

### PROJECT FACTS:

- Once capital costs have been repaid, it is predicted that the market garden could bring in £14,400 per year from retail sales, farm shop sales and vegetable box sales, based on 40 boxes per week in season.
- Using the no-dig method will mean that weeds are less intrusive once the crop beds are established, without causing a significant impact on productivity, and saving on labour costs.
- Installing agroforestry is likely to make over £10k per year from fruit lanes, once established.

### Background:

Can a small farm look at introducing greater biodiversity and more layers of production to increase ecosystem function, profitability, resilience and community engagement?

Henbant is trying to create a model of what this could look like, by introducing top and soft fruit trees into 20 acres of pasture and an ecologically based, no-dig market garden, alongside existing farming activities.

They are exploring a working model of what using agroecology on a small farm in Wales can achieve, in terms of increasing financial profitability, enriching ecosystems, building soil health and increasing social capital.

### Purpose of work:

1. The project aimed to improve biodiversity, thus aiding an organic, multifunctional land use approach, reducing environmental impact, increasing food production levels and mitigating climate change.
2. The project introduced a no-dig, bio-intensive, ecological approach, using the principles of permaculture by having multi-layered growing. Introducing top and soft fruit agroforestry lanes amongst both holistically managed pasture and a new bio-intensive no-dig market garden is an approach to diversifying and creating resilience on a small farm.

### Approach:

The current traditional field layout was changed to an agroforestry development by:

- Putting in field-scale veg rotation, along with agroforestry lanes.
- Planted top and soft fruit lanes amongst both grazing pasture and bio-intensive no-dig market gardening to add to the multi-storey approach.

Henbant chose plum, pear, cherry and apple trees for the fruit rows. These were chosen for their ability to make juice, for their disease resistance, and because they all crop at a similar time, therefore adding efficiency to the harvest.

### Outcomes:

It took three people one day to establish a set-up of 10 beds. This was with the use of a quadbike and trailer and a small digger for loading. For at least the first two establishing months, the garden benefitted from the full-time effort of two less-experienced people. After this, the garden probably required one full-time person for the rest of the season.

With some support from volunteers, a competent grower could run the market garden in 40 hours per week between April and September, and then with 20 hours per week in March, October to November; totalling 1,200 hours over the year. At £10/hour, this gives an annual labour cost of £12,000.

Over 500m of the top fruit tree lanes and 650m of the browse tree lanes were installed. This was about 70% and 20% of the planned total for the top fruit and browse lanes respectively. Areas were planted where the plan seemed sure, but given the commitment of the land and the cost, it did make sense to leave space for review and reflection and for full implementation over two years.

The total cost of this 500m of fruit-tree lane was about £2,640 for the plants, tree guards, inoculants etc, and about £2,000 for the browse tree lanes. The electric fencing cost about £1,800 (where the cost was spread across more field divisions than just the planted lanes).

The long dry spring meant that some trees were lost in the browse tree lanes. The more valuable fruit tree lanes were irrigated and had very few losses.

# Hendre Ifan Goch

Rhys Edwards

**LOCATION:**
**Bridgend**

**FARM:**
Red Meat
91ha in total
730 ewes (Aberfield mules and Welsh mules)
Lambing in January and March
Rotational grazing
5.5kW hydro generator
Farm park and trout fishery
Wedding/events venue
Slatted sheep shed

## FARM OBJECTIVES

1. To improve their carbon footprint
2. To improve animal health
3. To reduce production cost

## PROJECT 1:
Comparing various bedding options for in-lamb ewes pre-lambing

### PROJECT FACTS:

- Reduced bedding costs by 75%
- Fewer incidences of ewe lameness at housing since switching from straw bedding to slatted flooring

### Background:

Managing and selecting the correct bedding material for ewes could not only reduce costs, but also bring health benefits pre-lambing.

### Purpose of work:

1. To identify potential alternative bedding options that may offer superior attributes, in terms of cost-effectiveness and animal health and welfare, in comparison to traditional bedding materials such as straw.
2. The impact of different bedding materials have on factors such as labour, lameness, ewe cleanliness and overall animal welfare, and consider the cost-effectiveness of each bedding material with the aim of reducing production costs.

### Approach:

Five different types of bedding were compared in a trial for six weeks; these were: barley straw, wheat straw, sawdust, EnviroBed original and the slatted floors. The below was recorded during the six-week trial period.


*Figure 15: Recorded information to compare bedding options*

### Outcomes:

During the six-week trial period, only eight ewes were treated for lameness; of these, five of these had been on the wheat straw bedding.

In general, ewes on the slatted floor were cleaner than those on the other bedding options.

In terms of how much bedding was used, 340kg and 420kg of barley and wheat straw was used respectively over the six-week trial, with just over a tonne of sawdust used. Over a five-week period, 819kg of EnviroBed was used, but this ran out before the end of the trial. Labour spent bedding the pens was seen to be fairly similar across each bedding, with on average 30 – 60 minutes each week spent bedding the pens. It is worth noting that labour and bedding costs were not applicable to the slatted flooring.

**The actual cost of the bedding used over the six-week trial**

**Sawdust £21-worth used -** 11p per day per ewe
**Wheat straw £42-worth used -** 12p per day per ewe
**Barley straw £34-worth used -** 11p per day per ewe
**EnviroBed £155-worth used -** 30p per day per ewe
**Slatted Flooring** cost of slats [excluding labour and machinery] = £18,000

**Slatted floor's costing scenarios**
**10-year guarantee = assuming residual value of £5,000**

- Depreciated over 10 years= £1,300 per year
- House 500 ewes for 100 days = 3p per day per ewe

**25 years with no residual value**

- Depreciated over 10 years= £720 per year
- House 500 ewes for 100 days= 1.5p per day per ewe

*Figure 16: Slatted sheep shed at Hendre Ifan Goch*

# Moelogan Fawr

Llion & Siân Jones

**LOCATION:**
**Llanrwst**

**FARM:**
Red Meat
304ha in total
10ha woodland
6ha swede
Rotational grazing
145 Stabiliser suckler cows and 48 heifers
1,000 ewes closed flock (mixture of Welsh, Cheviot and crossbred ewes)
Spring calving
Lambing March - April
Glastir woodland creation scheme
Future Farms Cymru project - showcasing wireless technology

## FARM OBJECTIVES

1. Learn more about grass production on the farm to rear as much as possible from homegrown production to keep control of variable costs
2. Increase herd size through retaining breeding females and keep increasing the estimated breeding value (EBV) level of the suckler herd to maximise breeding sale potential
3. Benchmark the flock

## PROJECT 1: The use of technology to increase health monitoring and improving calving pattern and conception rates

### PROJECT FACTS:

- 95% of the heifers in-calf
- An increase of >10% in conception rates following first AI service after bolus administration
- The number of straws used decreased by 4% after bolus administration in comparison with the previous year
- 88% of the heifers calved within the first six weeks
- Early indication of non-cycling heifers by the bolus in 26% of cases, allowing for prompt vet intervention where required

### Background:

Artificial insemination (AI) is used on a high percentage of Moelogan Fawr's suckler herd. It is often difficult to identify heat in young heifers, and therefore, Llion and Siân were eager to look for a method of reducing labour requirements and aid with heat detection, as well as tightening the calving period.

### Purpose of work:

1. Reduce labour inputs by using bolus technology to improve heifer heat detection
2. Increase herd efficiency by tightening the calving period
3. Reduce the requirement and cost of veterinary fertility and health treatments

### Approach:

A total of 39 smaXtec rumen boluses were administered to yearling Stabiliser heifers in April 2020. The purpose of the bolus was to continuously measure each animal's activity and inner body temperature, which could give an insight into the animal's health status, as well as detect changes and send alerts at calving and oestrus. The monitoring period for heat detection commenced in June, with data gathered by the bolus, as well as via visual observations. Pregnancy scanning was carried out in October, followed by detailed analysis of the data gathered throughout the monitored period.

### Outcomes:

A graph containing all data gathered from the bolus and visual observations was produced for each individual heifer. The results have been summarised into key strengths and weaknesses.

### KEY STRENGTHS

✓ 95% of the heifers were in-calf
✓ Bolus and visual heat detection was conforming in 79% of cases
✓ 55% of the heifers had a regular heat interval, according to the bolus
✓ No indication of heat detection from the bolus when in-calf in 39% of cases
✓ There was an early indication of non-cycling heifers by the bolus in 26% of cases, allowing for prompt veterinary intervention where required

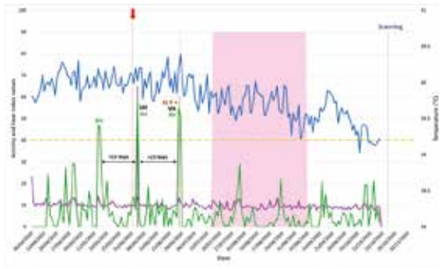


*Figure 17: Example of the data gathered for an individual heifer relating to the strengths listed above*

### KEY WEAKNESSES

✗ No indication of heat by visual observations in 8% of cases
✗ No indication of heat by the bolus in 11% of cases
✗ A lack of regular heat interval, according to the bolus, in 45% of cases
✗ Bolus heat index not reaching the threshold for detection during the monitored period in 21% of cases
✗ Bolus heat index exceeding the threshold when in-calf in 47% of cases

After bolus administration, the conception rates following the first AI service increased by 10% on the figure for the previous year. A total of 88% of the heifers calved within the first six weeks.

The project is currently in its second phase; for more information and further results, please visit:

"Being a demonstration site has been a fantastic opportunity for us to analyse specific aspects of the farm to hopefully improve profitability and future-proof the business. Both projects involved collecting and analysing data to improve flock and herd health and efficiency; this has allowed us to identify the stock that perform best on our upland farm."

# Moelogan Fawr — Llion & Siân Jones

## PROJECT 2:
Detailed flock recording to aid the selection of superior females

**PROJECT FACTS:**

Selection of superior females –

- ✓ Improves flock output
- ✓ Reduces the need for veterinary medicines
- ✓ Reduces greenhouse gas emissions
- ✓ Improves ewe longevity

**Background:**

Breeding ewe replacements within a closed system such as Moelogan Fawr gives the ability to develop the flock, based on the best performing ewes. As well as carefully selecting replacements, it is equally important to identify those ewes that are underperforming, with a view to removing them from the flock. Llion and Siân were eager to establish a good management system for their flock. On-farm records were used to help identify specific flock health, welfare and production aspects to address, in order to improve the farm's output and efficiency going forward.

**Purpose of work:**

1. Develop a consistent and effective method of recording flock data
2. Make use of technology to report on individual ewe and lamb performance
3. Select higher performing replacements to retain within the flock

**Approach:**

Approximately 320 ewes were identified to monitor at the outset. The ewes were weighed and their body condition score (BCS) recorded consistently throughout the project, to identify any changes in weight and BCS.

*Figure 18: Some of the ewes selected to be monitored.*

Detailed data was gathered at lambing, with any issues recorded (assistance required at lambing, prolapse, mastitis). Individual faecal egg count (FEC) samples were taken from the ewes, with mob samples taken from a proportion of the lambs. Lamb performance, as well as any health issues arising, was monitored throughout. All information was electronically recorded and the data collated to rank the ewes according to different variables and identify the best performers.

**Outcomes**:

The ewes were ordered according to a range of productivity metrics from the data collected. These metrics included those outlined in Table 6, as well as health issues correlated to lamb weight reared (lameness, mastitis, prolapse, joint ill). The age of ewe in relation to the lamb weight reared was also explored. The principal performance metrics used to aid the selection of the superior ewes are included in Table 6, with the average and range for each metric included.

*Table 6: Performance metrics used to aid the selection of the superior ewes.*

| Performance metric used for ewe ranking | Average | Range |
|---|---|---|
| kg lamb reared per ewe to weaning | 31.6 kg | 14-62 kg |
| Ewe efficiency (kg lamb reared per kg of ewe mated) | 56% | 20-107% |

Change in BCS would also be taken into account when selecting superior ewes since ewes that rear a lot of kg of lamb do need to recover BCS quickly to get in lamb again and perform well.

The project has enabled Llion and Siân to monitor the flock to a greater extent than in the past, which has highlighted performance improvements made over the project duration, as well as identifying any issues. One of the key performance improvements drawn from the results is the reduction in the incidences of lameness – from 12% to 1.5% in approximately three years. This has had a positive effect on the flock's cost-efficiency. Another notable improvement that was highlighted through the project's data collection was a reduction of 6% in lamb losses from scanning to lambing.



# Mountjoy — William Hannah & family

## PROJECT 1:
Selecting for efficient genetics in a spring-calving herd

**PROJECT FACTS:**

- Based on £ Profitable Lifetime Index (£PLI), the top-ranked animal had a +£282 genomic £PLI compared to the bottom at -£4, resulting in a lifetime earning potential gap of £286 between the two
- There was also a big range on milk-solid scores between heifers at either end, from a high of +61kg to a low of -757kg
- Even when set against a testing cost £25-£30 a head, there can be a big cost benefit from genomic testing
- At Mountjoy, the genomic somatic cell count (SCC) index ranged from +16 in the bottom ranked heifer and -4 in the top

**Background:**

Mountjoy farm is a late-spring block-calving herd, and is situated in a high-TB incidence area. Consequently, it has always reared more heifers than is necessary to compensate for the potential loss of cows and heifers in the herd, so as to maintain milk volume. The Hannahs took the decision to genomically test their youngstock to ensure that only the best heifers were reared to meet their particular genomic traits and selling only those that didn't fit these criteria.

Desired other genomic traits in no particular order:

- ✓ Weighted fat and protein
- ✓ Positive fertility
- ✓ Positive locomotion
- ✓ TB resistance
- ✓ Body depth and width
- ✓ Ideal cow weight

**Purpose of work:**

1. To ensure the right surplus heifers are sold, rather than making the decision based on birth date (which could lead to reduction in the genetic potential for milk yield if not managed correctly).
2. Together with targeted use of sexed semen, genomic selection offers many advantages with regards to improving the rate of genetic gain in dairy cattle breeding programmes.
3. Over the next 20 years, a 15% increase in herd genetics will return £20M back into the industry. This includes health-related traits like TB resistance using the TB Advantage traits/calf survival index, as Mountjoy sits in a high TB incident area (Andy Richardson 2015).

**Approach:**

Half the heifer calves born every year at the closed herd in Mountjoy (130) were tested and recorded.

Initially, the older heifers from the 2019 calving period were tested; the remainder were the calves from 2020.

The milking herd were weighed at 100 days in-milk, and with a completed 305-day lactation, a value of kgMS/kgLW was calculated for each milking animal. This then formed the basis to help decide which females to retain in the herd, in terms of efficiency, which will also be backed up by genomic testing for important health traits such as cell count, mastitis and TB resistance.

*Figure 19: Taking a genomic ear sample from R1's at Mountjoy farm - december 2019*

**Outcomes**:

TB Advantage is a genetic index published by AHDB Dairy to help dairy farmers make informed decisions to breed cows which have an improved resistance to bovine tuberculosis (bTB). The index indicates the degree of resistance to bTB a bull is predicted to pass on to his offspring, and is expressed on a scale which typically runs from -3 to +3 and, as for most other traits, positive values are desired. For every +1 point in the index, one per cent fewer daughters are expected to become infected during a TB breakdown.

*Table 7: TB weighting results*

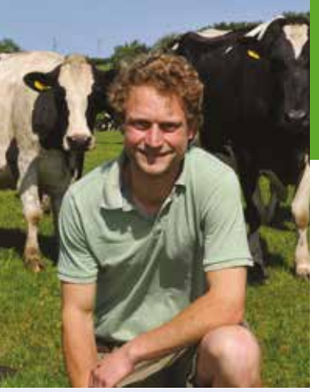
| | Group 1 Dec 2019 | Group 2 from 2020 |
|---|---|---|
| Number of heifers | 94 | 92 |
| TB Advantage average weighting | +0.80 | +0.84 |
| Numbers of heifers tested TB positive | 10 | 1 |
| TB Advantage average weighting | +0.66 | +0.70 |

**LOCATION:**
Haverfordwest

**FARM:**
Dairy
242ha in total
390 cow herd – Friesian cross
200 Friesian cross heifers
Rotational grazing
Late spring calving
Milk recording

## FARM OBJECTIVES

1. Improve kgMS/kgLW - from 500kgMS/kgLW to 520kgMS/kgLW
2. Improve fertility and locomotion by using genomics
3. Reduce N input without affecting grass growth
4. Ideal cow weight of 520kg



"At the outset of this project, we could see we weren't heavily stocked, and could see that we could grow a similar amount of grass with a lot less nitrogen. We were also interested in improving cow health and soil health as well. By reducing our nitrogen usage by half, we are seeing higher-than-average clover content in the swards."

# Mountjoy — William Hannah & family

## PROJECT 2:
Reducing nitrogen and incorporating more clover in the swards

**PROJECT FACTS:**

- Reduced total nitrogen (N) application by 50% whilst only reducing grass growth by 10%, resulting in a cost saving of £80/ha.
- Reducing summer N application where soil conditions and/or clover levels are high will have minimal effects on grass production, and should be encouraged
- Large reductions in spring N applications may have significant negative impacts on grass growth, and would not be advised, particularly for spring-calving herds
- Late-season N application can still be a sound investment where there is a high autumn grass demand – but there are likely to be increased environmental risks of N leaching into watercourses over the winter

**Background:**

Historically, the farm has used around 300kg of N/ha on the grazing platform. Will was keen to reduce the N input in relation to being prepared for future policies and the rising fertiliser costs.

**Purpose of work:**

1. To reduce N fertiliser use on the farm, whilst still maintaining (or increasing) the amount of milk coming from forage and maintaining milk quality and high levels of animal health/performance.
2. To investigate a range of fertiliser strategies (rate/timings) and sward/soil/slurry management regimes that may improve N use efficiencies.

**Approach:**

From 1 July 2019 – 30 September 2019, normal N rates (150kg) were cut by half (75kg), then a plate meter was used to measure the impact on one field in the grazing round.

The trial field was split into three sections:

| Section one – Normal N application | Section two – Half the normal N application | Section three – No N application |
|---|---|---|

The trial consisted of standard rate of N for the first four grazing rounds across the whole 11-acre field trial area, followed by a zero rate, half rate and full rate of N for four further grazing rounds from July to October 2019.

**Outcomes**:

Reducing total N by 50% grew only 10% less grass. However, it is important to note that this reduction relied on high levels of soil mineralisation and clover fixation through the summer. The use of summer N fertiliser still saw a response of over 20:1, therefore, if there was a demand for extra autumn grass, then the use of mid/late season N application still showed an economic return, even at £650/t (autumn 2021) for N. The cost of the extra grass production was around 10p/kgDM (at spring 2022 prices) – way below purchased feed or silage costs.

Autumn soil analysis measured mineral nitrogen levels as 60kgN/ha higher under the full rate than the half rate.

The cold spring of 2021 meant there was very little mineralisation or clover fixation, and the zero-N area was way behind the N areas. In the period to 1 July, the zero-N area grew half as much grass (4,350 v 2,310 kgDM/ha), following the initial sweep round the platform with dry cows in January.

Summer mineralisation and fixation helped the zero-N plot to close the gap slightly – but they still recorded a 4tDM/ha deficit. Summer clover levels were higher in the zero-N area 23% DM vs 13% DM (from sward separation data), but sward quality was similar at 14% crude protein.

The half-rate summer trial once again had a small impact on total grass growth – a 19% reduction in N use led to only a 5% reduction in grass growth. As in 2020, in purely financial terms, the full rate N still provided a good return on investment, compared to the half rate with a response of 22kgDM per kgN applied.

# Nantglas — Iwan Francis

## PROJECT 1:
Improving fertility of a split block calving system

**PROJECT FACTS:**

- Six-week in-calf rates increased from 71% in spring 2020 to in excess of 80% by autumn 2022
- Reduced 12-week empty rate to under 5% from 14% during the same period
- Estimated UK multiplier of £3/cow per % increase in six-week in-calf rate and £7.50/cow per % decrease in NIC rate
- Halved the amount and severity of metabolic disorders around calving from estimated 15% in autumn 2019

**Background:**

There are many factors contributing to good on-farm fertility performance and there is rarely a single solution to improve fertility. Contributing factors range from energy and protein nutrition, cow comfort and lameness to AI technique, naming only a few. The aim of tightening the calving blocks to a more concentrated 10 weeks each would allow Iwan more time to focus on other areas of his business. The goal is then to get the cows back in-calf more efficiently, without increasing empty rates.

**Purpose of work:**

The key aim of this project was to make improvements to boost the six-week calving percentage and six-week in-calf percentage. Changes will be made to several management practices, as there is no single cause of poor fertility. The project focused on monitoring and benchmarking the following influencing factors:

- Introducing heat-detection collars and increasing heat detection rate
- Calving heifers earlier i.e. "front-end loading" the calving pattern
- Nutrition
- Cow comfort
- Disease status
- AI protocol

**Approach:**

A planned mating programme for heifers was designed, including strategic prostaglandin to help with front-end loading the calving pattern.

✓ The management of magnesium supplementation to pre-calving cows was reviewed

✓ More detailed record-keeping and analysis of risk factors around calving.

✓ Metri-checking the whole herd, with early treatment of positives and early intervention on non-cyclers

Iwan invested in heat-detection collars, based on reliability and effectiveness, which helped maintain high submission rates. Measuring and monitoring at-risk cows (e.g. metabolic problems, late calvers and calving problems) has shown significant differences in-calf rates for these groups.

**Outcomes**:

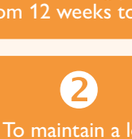
There has been a positive impact from front-end loading the calving pattern by utilising planned mating programmes (strategic prostaglandin) for the heifers. The full benefit of this is expected to continue and likely to be realised well into the future with, for example, the easier management of an early- and tight-born heifer replacement group. Also, heifers will likely calve at 24 months-old (instead of the historical range of 22-24 months). The collar system has proved reliable and effective for heat detection, and Iwan has maintained his high submission rates with less effort than he used to have to put into heat detection.

Measuring and monitoring cows 'at risk' (e.g. metabolic problems, late-calvers, calving problems etc) has shown significant differences in-calf rates for these groups.

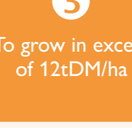
Nantglas has successfully shortened the calving period from 12 weeks to 10 weeks or less, with a predicted 100 cows due to calve in 40 days in autumn 2022. The amount and severity of metabolic disorders around calving has also halved, which has also helped to reduce the 12-week empty rate to less than 5%.

**Other projects taking place on this site:**

1. Increasing milk from forage
2. Pica case study



**LOCATION:**
Talog



**FARM:**
Dairy
55ha in total
75ha off-lying rent
200 cow herd – Friesian cross
120 heifers
Rotational grazing
Split block calving
Heat-detection collars

## FARM OBJECTIVES

1. Reduce calving period from 12 weeks to nine
2. To maintain a low empty cow rate (currently under 10%)
3. To grow in excess of 12tDM/ha

# Pantyderi Wyn & Eurig Jones

Pantyderi Wyn & Eurig Jones

**LOCATION:**
**Boncath**

**FARM:**
Red Meat and Arable
445ha in total
3.5ha woodland
45ha spring barley
16ha winter cereals and forage rape
80 Hereford x suckler cows
400 cattle finished
1,800 Texel X ewes
Lambing in March - April
Manor house wedding and staycation venue
Glamping pod
Halloween pumpkin patch

## FARM OBJECTIVES

1. Improve resilience and sustainability
2. Increase output from own resources
3. Reduce bought-in feed and fertiliser
4. Improve efficiency of input use

## PROJECT 1:
## Soil mapping to enable more precise land management

### PROJECT FACTS:

- Spreading lime by variable rate saved £12/ha in lime cost on arable land and £8.10/ha on grassland, compared to flat-rate application
- Sowing barley using a variable seed rate based on soil mapping data increased grain output value by £70/ha, leaving a net gain of £66/ha after allowing for the extra seed cost
- Using field soil maps allows more precise allocation of nutrients, improving nutrient use efficiency, and providing for a better environmental outcome

### Background:

Nutrient and lime application to land is normally based on a single soil nutrient analysis for the whole field.

Making precision farming efficiencies by using variable rate farming techniques relies on having accurate knowledge of soil characteristics across the span of the growing area. It is now possible, using Electrical Conductivity (EC) scanning techniques, to map precisely how different soil properties vary across a field, and then to divide the field into management zones on this basis.

### Purpose of work:

1. To identify whether soil mapping can improve efficiency of lime and nutrient inputs
2. To apply nutrients contained in muck and slurry in a more informed manner

### Approach:

Soil EC scanning and subsequent within-zone soil sampling was conducted on 40ha of grassland and 60ha of cereal growing land. The zones created have all been analysed for phosphate(P), potassium(K), magnesium(Mg) and pH, as well as laser texture, to give an absolute value to soil type. Nutrient management plans have been drawn up for every mapped field; these are being used for variable rate nutrient and lime applications.

This field map (Figure 20) is colour-coded for pH, with soil sampling indicating that zones A and C require a greater lime input to bring the soil pH to the optimum for grass production at 6.3.

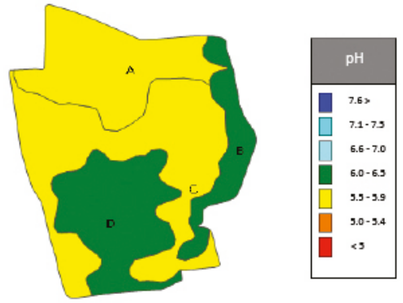



*Figure 20. Soil pH zones for one field*

### Outcomes:

The use of soil mapping has identified a saving in lime applications on both the grassland and arable area, by using variable rate lime spreading.

*Table 8: Savings in lime applications using variable-rate lime spreading*

| | Grassland 40ha | | Arable 60ha | |
|---|---|---|---|---|
| Rate | Flat | Variable | Flat | Variable |
| Lime (tonnes) | 182.1 | 171.3 | 170.0 | 146.0 |
| Cost (£) | 5,463 | 5,139 | 5,100 | 4,380 |

Similarly, barley and straw yields were increased by sowing the seed using variable rate, and after allowing for the extra seed cost, the net gain was £66/ha.

*Table 9: Spring barley crop yields and costings*

| | Flat rate | Variable rate | Difference |
|---|---|---|---|
| Barley yield t/ha | 5.2 | 5.6 | +8% |
| Straw bales/ha | 14 | 16 | +14% |
| Value grain £/ha | | +£70 | |
| Extra seed cost £/ha | | +£4 | |
| Net gain £/ha | | +£66 | |

## PROJECT 2:
## Growing a protein feed concentrate

### PROJECT FACTS:

- 27% protein concentrate feed produced for the farm at growing costs of £117 per tonne
- Cost savings of £5,588 compared to previous winter for feeding 200 cattle for eight months
- 60 tonnes $CO_2e$ saved from not purchasing bought-in protein concentrate
- Legume nitrogen-fixing has generated up to 100kg/ha nitrogen for the following wheat crop worth £1,508, and saving another 2.72tonnes $CO_2e$

### Background:

Alongside grass silage, the growing of cereals provides enough starch energy to grow and finish the 400 beef cattle at Pantyderi every year; however, a 36% protein concentrate blend (rape meal and maize distillers grains) was bought in to make up the protein shortfall in the ration.

### Purpose of work:

1. To select and grow a suitable high-protein crop on the farm
2. To identify a crop that could be combined and crimped (like the barley used on-farm), and stored in an outside clamp
3. To incorporate the protein feed in growing and finishing beef rations and compare performance and costs to the previous rations based on the bought-in blend

### Outcomes:

Following consideration of several options, it was decided to bi-crop peas and beans, which yielded 5.25t/ha of peas and beans and 22 haulm bales/ha.

*Table 10: Analysis of peas and beans and haulm*

| | Peas/beans | Haulm |
|---|---|---|
| Dry matter (DM) % | 61.7 | 32.5 |
| ME MJ/kgDM | 13.6 | 7.5 |
| Crude protein % DM | 26.6 | 8.0 |
| D value % | 93.4 | 47 |

### Crop costings

The farmer kept detailed costings of labour and fuel costs for all operations, to provide a cost to the farm for growing the crop, and an external consultant used contractor rates to calculate crop costings, which also included a land rental value (Table 11).

*Table 11: Crop costings*

| | Farmer costings | Contractor costings (inc. land rent) |
|---|---|---|
| Growing costs £/ha | 432 | 917 |
| Harvesting cost £/ha | 100 | 100 |
| Crimping and additive £/t | 24 | 24 |
| Cost of production £/t (less haulm value): | | |
| @ Fresh weight 62% DM £/t | 84 | 161 |
| @ Concentrate equivalent 86% DM £/t | 117 | 223 |

### Feed rations

Beef rations of equal energy and protein to the previous winter's diets were formulated; the cost savings for feeding the peas and beans are shown below (Table 12).

*Table 12: Beef ration costs*

| | Growing ration | | Finishing ration | |
|---|---|---|---|---|
| Year | 2020 | 2021 | 2020 | 2021 |
| Cost/head/day £ | 1.35 | 1.29 | 2.39 | 2.18 |
| Cost saving £* | 1,800 | | 3,788 | |

**Cost saving based on 200 cattle being fed for five months on the growing ration and three months on the finishing ration, using contractor costings for peas and beans*

Monitoring of liveweight gains showed that the cattle were averaging 1.5kg/head/day, which was slightly above ration predictions, and better than the previous winter.

*Figure 21: Peas and beans 7 July 2021*

"Although it was a bit worrying growing the first field-scale double crop of peas and beans and working out how to harvest them, the crop proved easier to combine than I first thought. They have fitted into our feeding system really well and saved us money, plus the animals have performed exceptionally well. I am increasing the area grown by 50% this year, so that we have enough to take us through the whole winter. The savings in nitrogen fertiliser for the following wheat crop has also proved a big bonus for us this year."



## PROJECT 1:
Impact of rotational grazing on soil organic matter

### PROJECT FACTS:

*Grass production*

- Peak grass demand has increased by 52%, from 21kgDM/ha/day to 32kgDM/ha/day
- Estimated increase of 52% in grass production, from 5.25 tonnes DM/ha to 8 tonnes DM/ha

*Stocking rate*

- Peak stocking rate has increased by 50% from 1,000kgLW/ha to 1,500kgLW/ha
- kg liveweight produced increased by 24% from 525kgLW/ha to 650kgLW/ha
- At £3/kgLW, this is an increase in revenue of £375/ha (£6,750 over the 18ha)

*Input*

- Concentrate use reduced by 52% from 21t to 10t
- Inorganic fertiliser use reduced by 67% from 9t to 3t (in 2022)

### Background:

Farmers have environmental responsibilities, which are being increasingly highlighted. Improving soil health and in doing so, increasing organic matter content, has both production and environmental benefits. Ongoing studies highlight that rotationally grazing cattle can improve soil organic matter content; however, studies are limited for the benefits in rotationally grazing sheep. This project aims to evaluate the benefits of rotationally grazing sheep, in comparison to set-stocked grazing, on the soils organic matter content. Tom has already identified the benefits of rotational grazing on maximising stocking density and grass utilisation, and is involved in the Welsh Pasture Project, which monitors grass growth on 49 farms across Wales.

### Purpose of work:

1. Improve soil organic matter by 0.5% at 0-150mm depth and 0.2% at 150-400mm depth
2. Improve farm productivity (kg/ha) by 25%
3. Improve grass growth (kgDM/ha) by 25%

### Approach:

An assessment of soil health was undertaken on two sections of the farm that had contrasting grassland management. One section was primarily set stocked, while the other section was grazed in rotation. The soil health assessment involved a laboratory test of soil nutrients and organic matter content at different depths, a water infiltration test, plus a detailed visual assessment (using the SRUC Visual Assessment of Soil Structure) that involved an assessment of soil structure, plant root depth, anaerobism and earthworm activity.

### Outcomes:

At Pendre, initial findings were positive. There has been an increase in grass yield and in the percentage of productive plants in the sward rotationally grazed, which suggests an improvement in soil fertility. Results of the visual assessments show that root depth has increased by 1cm on average, indicating that the rest period and higher average pasture height of the rotational grazing area results in deeper roots. The deeper roots will provide resilience, and should contribute towards organic matter build-up at a later date. The soil organic matter test results of the trial did not show a significant difference in soil organic matter content during the two-year period. The results have shown that two years of the management implemented at Pendre is not sufficient time to initiate a significant change in soil organic matter content. Another similar trial was held at Rothemstad Research, Devon, which involved grazing cattle, rather than sheep, entering higher covers and leaving higher residuals over a five-year period, and displayed a significant increase in organic matter content.

"Rotational grazing for us is a no-brainer! We don't have much ground at the home farm, so through rotational grazing, we are able to utilise grass efficiently, increase stocking rates and also reduce input costs. This year, I have not creep-fed the lambs at all, so it has certainly been worth the time and effort to set up."

**LOCATION:**
**Aberystwyth**

**FARM:**
Red Meat
24ha in total
73ha rented
2.5ha woodland
Rotational grazing
480-ewes split into three flocks
Mule crossbred
Improved Welsh Tregaron-type
Welsh Hill speckled face ewes
Lambing indoors between 20 February and 20 March
Hill ram scheme to breed rams with EBV
Glamping
PYO pumpkin enterprise

### FARM OBJECTIVES

1. Improve grass utilisation
2. Reduce input costs e.g. fertiliser and concentrates
3. Improve forage quality



Pendre Tom Evans & family

## PROJECT 2:
Improving productivity from grass through overseeding

### PROJECT FACTS:

- Timing and weather conditions have a huge bearing on the success of overseeding
- Managing grazing effectively post-overseeding is essential for establishment

### Background:

Pendre is highly stocked in the spring and early summer post-lambing, therefore Tom was keen to improve sward quality and early season production. To achieve that through reseeding is difficult, because taking land out of production puts pressure on grazing. Overseeding offers a potential short-term solution, but there are challenges associated with this, as the project at Pendre has demonstrated.

### Purpose of work:

1. To improve forage quality
2. To grow more protein and increase ryegrass clover content in sward
3. Reduce the costs of inputs such as feed and fertiliser

### Approach:

On 11 September 2020, two different seed mixes were drilled in two fields that were low in clover and ryegrass. Ideally, the fields should have been drilled four weeks earlier, but demand for grazing ruled that out. One field was sown with a vigorous mix of hybrid ryegrass and festulolium to boost early season grass growth, and the other with clover and perennial ryegrass; one half of that was sown with seed treated with a lime coating and fertiliser.

In June 2021, following silage, a field was split in two and one half drilled with white clover(2kg/acre), and the other with white clover and plantain (0.5kg/acre and 1.5kg/acre) A section of this included plantain, to see if this could be successfully oversown. A wet autumn followed, but it was managed well through the wet conditions by grazing to allow the seeds to tiller out, but not at a level to graze out the seedlings.

### Outcomes:

In spring 2021, the ryegrass level in the ley oversown with hybrid ryegrass and festulolium had been boosted to 60%, compared to 20-30% prior to overseeding, and festulolium was evident in the sward. However, there was no evidence of surviving clover or plantain in the sward of the other ley. There was no evidence that the seed treatment improved establishment or survival. The timing of the seeding in autumn 2020 was late, and was followed by a cool wet October – which may well have limited establishment.

The overseeding in June 2021 was more successful, with new clover and plantain plants clearly visible in the drill lines. In October, the sward was assessed – with plantain recorded at 50 plants/m$^2$. The white clover plants were still small, and made up less than 5% of the sward dry matter – it is hoped that the clover levels will build in 2022 as the plants mature.

*Figure 22: Grass, clover and plantain mix*

### How to apply on your farm:

- ☑ July or August are the ideal months for oversowing – any earlier, and the germinating seeds would need to compete with established swards at peak growth rates.
- ☑ Keep grazing pressure tight beforehand, and never be too ambitious with acreage – start with a few acres at a time.
- ☑ The seeds most suited to overseeding are the biggest: hybrids and tetraploids. These are not the best grazing varieties, but overseeding is a means of topping up the sward and producing the best quality grass in a short period of time. It is a struggle to get diploid varieties with smaller seed to germinate quickly and compete - and the results are not as effective.
- ☑ Grazing pressures need to be reduced through the autumn/winter following overseeding, to allow the new plants to mature – rotational grazing is recommended – with short grazing periods of two or three days.
- ☑ Avoid fertiliser applications following overseeding. This will encourage the existing grass to outcompete the new seedlings.

"Overseeding can work well to improve sward quality with little investment; however, timing is key for success. I do believe that adding clovers and plantain to mixes has a role to play to improve animal performance and also reduce input costs."

# Pentre Farm

Hugh Jones

**LOCATION:**
**Ruthin**

**FARM:**
Red Meat
53ha in total
6.25ha woodland
100 Aberdeen Angus X dairy steers (purchased as calves and taken through to finishing)
300 Lleyn and New Zealand Suffolk X Lleyn ewes
NZ Suffolk X Lleyns lamb mid-February, Lleyns lamb in April
Glastir
Rotational grazing
Future Farms Cymru project - trialling innovative technology

## FARM OBJECTIVES

1. Continue to improve grazing management
2. Keep control of variable costs, rearing as much as possible off grass
3. Analyse flock data to look at ways of increasing birth rates and subsequent number of lamb sales
4. Reduce beef age at slaughter

## PROJECT 1:
Evaluating the effectiveness of chicory in Welsh sheep systems

### PROJECT FACTS:

- Lamb performance (DLWG) for the Year 1 grazing period was greater for the lambs grazing the pasture containing chicory than those grazing the pasture containing white clover – although this difference was insignificant
- Lamb performance was comparable for both grazing treatments in Year 2 – the ryegrass-based mixture including white clover and the ryegrass-based mixture including chicory
- Climatic conditions resulted in difficulties with regards to reseeding, and as a result, grazing time was lost in the first year
- Development of the rotational grazing system as the trial progressed resulted in increased grass supply

### Background:

Previous work has indicated that the inclusion of chicory within a pasture mix can provide several benefits – such as increased lamb liveweight gain and improved supply of micronutrients. However, information on this in relation to Welsh sheep systems remains relatively limited.

### Purpose of work:

To determine the effectiveness of the inclusion of chicory with ryegrass in different proportions in the sward in terms of:

a. lamb performance
b. sward and diet quality
c. internal parasites

### Approach:

Approximately 1.8ha of land was reseeded with a standard ryegrass-based mixture including white clover, and another 1.8ha reseeded with a grass mixture including chicory. After weaning, lambs were grouped to graze both treatments, with a rotational grazing system implemented.

Data collection included:

- Regular weighing of the lambs to determine their daily liveweight gain (DLWG)
- Blood testing a sample of lambs within each group at the beginning and end of the grazing period, to monitor cobalt, copper and selenium concentrations
- Pasture quality and quantity
- Faecal egg counts (FECs) to monitor internal parasite burden

*Figure 23: Field trial set-up at Pentre Farm*

### Outcomes:

In Year 1, lamb performance was marginally better from the treatment containing chicory (193g/day) than those grazing the treatment containing white clover (168g/day); However, in Year 2, the DLWG of both groups of lambs was comparable. Sustaining the required stocking rate proved to be a challenge, as lambs were becoming fat and leaving the farm, without surplus lambs to bring onto the paddocks.

Blood samples were taken for copper, selenium and cobalt analysis from 10% of the lambs on two occasions: at the beginning and end of the grazing period. The blood sample results were all within normal ranges at the beginning of the grazing period, with one lamb a fraction low in cobalt and another lamb borderline low in selenium, but this result was of little significance. At the end of the grazing period in Year 1, the blood test results indicated elevated copper concentrations for the lambs grazing the pasture containing chicory (Figure 24), which indicates that grazing the chicory led to an increase in copper in the blood.

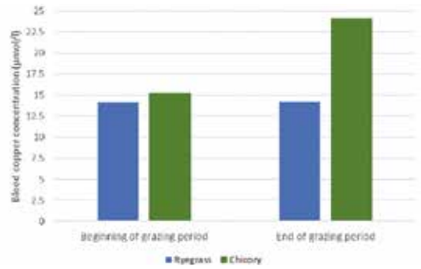



*Figure 24: Blood copper concentration at beginning and end of grazing period for lambs grazing the ryegrass-based pasture, and the pasture containing chicory.*

Fresh sample analysis also indicated that copper content was high in the ryegrass-based mixture containing chicory, at 11.1mg/kgDM. The FEC results were comparable for both groups of lambs.



Pentre Farm Hugh Jones

## PROJECT 2: Management of ewe nutritional needs to reduce health issues around lambing

### PROJECT FACTS:

- The number of prolapses occurring at Pentre Farm was significantly lower in 2021, compared with 2020 figures
- The cause of prolapses is multi-factorial, and adopting suitable prevention methods is fundamentally important
- Ewe mineral inputs at Pentre Farm were adequate, but appropriate nutrition and regular BCS and weighing is key

### Background:

Ewe body condition, nutritional supply of energy and protein and the ratios of macro minerals can be contributing factors towards prolapse incidences. Prolapses have significant effects on ewe longevity and productivity; high levels of the condition are detrimental to flock performance and profitability. Nearly 10% of the closed flock at Pentre Farm prolapsed in 2020.

### Purpose of work:

The overarching aim of the project was to target the prolapse and mastitis issues occurring at Pentre Farm by considering various aspects that influence the flock's productivity and performance, and correcting these issues. The monitored aspects include the supply and balance of both energy and protein to the ewes during pregnancy, as well as their mineral supply. Identifying the cause of the issues should aid decision-making from a management perspective (e.g. when implementing a grazing/feeding plan and selecting ewe replacements).

### Approach:

The flock at Pentre Farm was grouped according to breed, age and body condition score (BCS). Existing data on ewe BCS and weights were already available, as Hugh was regularly collecting this data. The records were analysed, along with further data collected during the project, with any potential annual variations in data taken into account. Detailed recording of prolapses and mastitis cases was carried out (at lambing and throughout the summer), and milk samples collected to identify mastitis organisms. A full mineral audit was completed whereby the supply and balance of both energy and protein to the ewes throughout the year, as well as their mineral supply, was analysed.

### Outcomes:

The mineral audit results showed that the supply of key minerals in the diet throughout the year was sufficient to meet the ewes' requirements, and the ratios of calcium and magnesium (Figure 25) in late pregnancy seem appropriate. There may be cobalt and selenium issues on the silage fields, but these were not an issue on the main grazing fields.

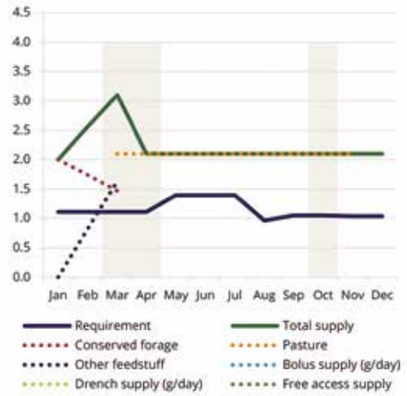



*Figure 25: Magnesium supply to the ewes*

The extensive body condition score data indicated that there was not a clear correlation between prolapse cases and ewe BCS. This demonstrated that it is not simply the case that the fatter ewes are more likely to prolapse in all incidences (with the data highlighting the opposite in some individual ewes); however, prolapses may, in fact, be linked to ewes depositing their fat in the abdomen.

Various changes were implemented at Pentre Farm last year, which included encouraging the pregnant ewes to eat hay alongside grass to increase their fibre intake, encouraging a good rumen environment and improved gut transit times. The ewes were also fed at the top of the hill each day, to compel them to walk up in order to keep fit. Historical body condition scoring data are currently being analysed, giving us some early insights into the issues for this flock. One practical step taken at lambing time was ensuring that the tails of ewe lambs were docked at a reasonable length, that is, not too short and definitely long enough to cover the vulva. This confirmed that the cause of prolapse cases is, in fact, multi-factorial.

"Becoming involved in the Farming Connect programme was a great opportunity for me to push on with a lot of the ideas I had – implementing rotational grazing, trying to reduce the inputs that I'm using, and making best use of the resources that are available on the farm."

# Plas yn Iâl

Huw & Bethan Beech

## PROJECT 1:
Continuous cover forestry in farm woodlands

**LOCATION:**
**Llandegla**

**FARM:**
Red Meat and Forestry
75ha in total
12.5ha woodland
Transitioning to rotational grazing
400 Lleyn and Beulah flock
Outdoor lambing in April
Tir Gofal and Glastir
Holiday lettings
80kWth wood-chip boiler
Thermal solar panels
4kW Bank of PV on farm building

## FARM OBJECTIVES

1. Acknowledge that 12.5ha of woodland is a valuable resource for the farm
2. Maintain the numerous priority habitats on the farm in favourable condition
3. Improve grassland swards

### PROJECT FACTS:

- The woodland volume is increasing at an estimated volume increment of 7.19m³/ha/yr, equating to approximately 90 tonnes of timber per year; this has an energy equivalent of 178,365kWh/yr.
- Plas yn Iâl's wood fuel demand is approximately 60,000kWh/yr, which means that introducing Continuous Cover Forestry (CCF) as a silvicultural management technique could provide 60 tonnes/118,365kWh of saleable timber annually.
- The remote sensing trial provided accurate stem counts for conifer plantations due to its ability to differentiate between different crowns.
- At Plas yn Iâl, broadleaves are the dominant woodland type, therefore stem counts were difficult to calculate at times.
- Remote sensing is useful to assist in assessing transformation to CCF.

### Background:

Huw aims to integrate income generation whilst improving and enhancing environmental and biodiversity benefits, by increasing the capital value of the woodland on the farm and providing multiple benefits in a cost-effective way. CCF is therefore a very suitable management method whereby individual trees are extracted to maintain permanent woodland cover; this allows the production of commercial timber as a product, whilst maintaining biodiversity.

### Purpose of work:

1. Improve overall woodland management at Plas yn Iâl, which will contribute a sustainable timber supply towards the farm's energy needs.
2. Prepare and implement a CCF woodland management plan, combining results of both ground and remote sensing surveys.

### Approach:

The project looked at assessing the history and condition of the woodland, planning the transformation to CCF and monitoring the progress of transformation.

This was be done by:

- Undertaking both ground and remote sensing surveys.
- Combining results from both ground and remote sensing surveys to create one CCF management plan.
- Analysing the effectiveness of remote sensing to see if it is suitable to be extrapolated over larger areas; this could then reduce the need for ground surveys, with the objective of reducing cost.

*Figure 26: Ground sensing taking place at Plas yn Iâl*

### Outcomes:

The ground survey undertaken in December 2020 was designed to sample the farm woodland to record the woodland types, species composition and the productive capacity of the woodland. Ten sample plots were located to gather the wide range of variation in woodland types.

The results gathered showed that the highest proportion of any one species across the entire woodlands was sycamore at 30.2%, followed by beech at 26.1%, other broadleaves (including oak and ash) at 13.8%, and conifers at 30.5%. The overall growing stock was 31.8m²/ha, with an average number of 220 trees per hectare. The woodland increment equates to approximately 90 tonnes of timber per year, having an energy equivalent of 178,365kWh/yr. Plas yn Iâl's wood fuel demand is approximately 60,000kWh/yr, which means that introducing CCF as a silvicultural management technique could provide 60 tonnes/118,365kWh of saleable timber annually.

With the data collected from both surveys, a Woodland Management Plan has been written. The plan will be used as a guide to manage the stands' transformation to Continuous Cover Forestry to meet the local demand for wood, and to produce high-quality timber, as well as meeting the farm's environmental objectives.



# Rhiwaedog

Emyr, Aled & Dylan Jones & family

## PROJECT 1: Evaluating the benefits of heat detection technology to provide gains in suckler cow fertility

**LOCATION:**
**Bala**

**FARM:**
Red Meat
260ha in total
6ha woodland
121ha rented
80 Welsh Black suckler cows
1,400 ewes split into three groups
Texel x Mules and Aberfields / Cheviot x Welsh ewes / Welsh ewes
Spring and summer calving
Holiday lettings
Biomass boiler

## FARM OBJECTIVES

1. Tighten the calving period into two blocks in spring and early summer
2. Reduce winter feed costs by growing high protein silages
3. Depend less on bought-in feed by making better use of grass

### PROJECT FACTS:

- With an average variable cost of keeping a suckler cow estimated to be between £300 and £450 per year, it is essential to ensure each cow produces one live calf per 365 days. The longer the gap between calvings, it is harder to get her back in-calf.
- Moocall HEAT electronic tags can identify a problem earlier
- Calving interval reduced from 392 days to 367 days.

### Background:

The calving period at Rhiwaedog had spread from February to October, as in the past stock bulls (one young bull and another a proven stock bull) had been sub-fertile – which was not detected early on. This resulted in an extended calving pattern, which made it difficult to manage calving and grouping store cattle for sale.

### Purpose of work:

1. Tighten the calving periods into two blocks of eight weeks (February-March and May-June)
2. Reduce calving interval to 'one live calf' per 365-375 days
3. Ensure optimum herd health and fertility.

### Approach:

✓ All stock bulls were fertility-tested

✓ All cows were tagged with Moocall HEAT electronic tags and linked up to the Moocall dashboard individually. A Moocall HEAT electronic collar was placed on the stock bulls.

The collar uses information based on proximity, mounting behaviour and activity levels to determine to a high accuracy when cows are in heat. When a cow/heifer is in heat, a message is sent through the app or by text.

Any cows that were identified as not cycling as they should were explored further through a physical examination by the vet and treated accordingly or, if appropriate, ovulation was synchronised with CIDRs (progesterone releasing intrauterine devices).

### Outcomes:

In 2021, this measure – in combination with pre-calving checks – resulted in a condensing of the calving period, from March to September, but with 84% of cows calving within the two preferred calving blocks. Just 5% calved in August and 4% in September.

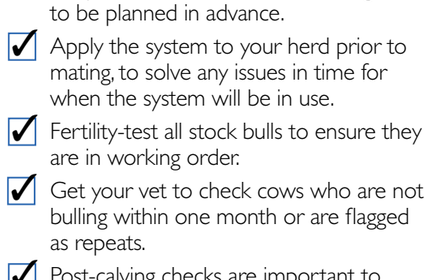


*Figure 27: Cows calved in 2021 vs 2022*

The technology was again used in the 2021 breeding season, and it has resulted in the predicted calving period being shifted further. The calving period extended from February to August 2022 and half of the herd (35 cows) calved in May.

Due it being a pedigree herd, the aim at Rhiwaedog is to bring the late calvers forward without having to cull healthy cows from the herd.

This system cost £1,095 and included one collar and 50 cow tags, along with network service, notifications, and software updates for 12 months.

### How to apply on your farm:

- ☑ Many heat-detection technology systems are available. It is important to find the one that best suits your system and farm.
- ☑ Get your vet involved from the start of the process in order for monitoring visits to be planned in advance.
- ☑ Apply the system to your herd prior to mating, to solve any issues in time for when the system will be in use.
- ☑ Fertility-test all stock bulls to ensure they are in working order.
- ☑ Get your vet to check cows who are not bulling within one month or are flagged as repeats.
- ☑ Post-calving checks are important to identify any infections and to ensure cows are fit to be bulled again.
- ☑ Consider what steps to take with cows that are repeating, or those calving later.

"Being a demonstration site has allowed us to explore the potential of herbal leys. We favoured the red clover ley, which gave us ample grazing, and ewe lambs thrived on it."

# Rhiwaedog

Emyr, Aled & Dylan Jones & family

## PROJECT 2:
Improving productivity and efficiency from grass

### PROJECT FACTS:

- Flatter growth curve through the season, but in dry periods, multi-species leys should keep growing for longer than the ryegrass, because the plants are deep-rooting.
- Whilst diverse species can provide high levels of energy, protein and mineral status, dry matter can be low. In wetter conditions, you might find that livestock can't physically eat enough to provide the protein and energy they need to perform.

### Background:

Multi-species leys provide livestock with nutritional benefits not available in grass and boost soil health – but selecting a mix that matches the livestock system is important.

### Purpose of work:

1. To improve forage quality
2. To grow more protein and increase clover content in the sward
3. Reduce input costs (such as feed and fertiliser) where possible

### Approach:

A very diverse multi-species ley was established in July 2020 and germination was assessed in early August. After an initial short graze in August to encourage tillering and control the annual weeds, the first full graze began in mid-September.

A simpler multi-species ley, containing red clover and chicory, was also seeded in August of the same year.

| Diverse multi-species mix | Simple multi-species mix |
|---|---|
| Perennial ryegrass (4%) | Perennial ryegrass (70%) |
| Festulolium (7%) | Timothy (6%) |
| Timothy (6%) | Red clover |
| Cocksfoot (8%) | White clover |
| Meadow Fescue (6%) | Chicory |
| Crimson clover | |
| Sainfoin | |
| Alsike clover | |
| White clover | |
| Red clover | |
| Birdsfoot trefoil | |
| Lucerne | |
| Chicory | |
| Plantain | |
| Yarrow | |
| Sheeps parsley | |
| Salad Burnet | |

### Outcomes:

Initial species counts with the diverse ley found that all of the components had successfully established, and that in this early phase, yarrow had been very successful, sainfoin less so – and that weeds were also successfully competing with the new ley.

A year later, the grass component dominated the sward, and much of the diversity had disappeared. Weed grasses (mainly meadow grass) and docks had filled the fairly open sward, replacing the herbs and some of the legume species.

Early spring grazing pressure may have been mainly responsible for the change in sward make-up. Grass supply in the cold spring of 2021 meant that stock probably stayed on the ley too long and grazed a bit tightly.

The simpler multi-species ley was cut twice in 2021 and sward assessment undertaken just prior to cutting.

First cut was dominated by the ryegrass, but nearly one third was red/white clover. In the second cut, the red clover and chicory formed a greater proportion of the sward. Red clover continued to build and by the time lambs were grazing in the autumn, it made up almost 50% of the sward.

### Feeding the simple multi-species ley as silage

The red clover silage between two cuts gave an average of 13% crude protein (CP) in the dry matter and supplied 83MJ. To achieve 1kg DLWG, 20kg of silage with an additional 1kg of a 18% CP concentrate would need to be fed per animal per day, giving a 14% CP diet totalling 95 pence a day in cost. Another option would have been to feed 0.8kg of wheat distillers, giving 15% CP at the same cost.

To achieve the same growth rates with a rye grass silage would require feeding 24kg of silage, plus 2kg per day of 18% concentrate costing £1.14 per day. Feeding 24kg rye grass silage with a mix of 1kg of distillers and 1kg of 18% concentrate would cost £1.22 per day, increasing the protein to 15.5%.



# Wern

Osian Williams

## PROJECT 1: Enhancing bird health and performance through the use of sensor technology to control air, litter and water quality

### PROJECT FACTS:

- Ammonia in the shed has been reduced by up to 75%.
- Reducing the frequency of mucking out from twice a week to fortnightly reduced labour requirements by more than 75%.
- Bird health has improved, resulting in no antibiotics being used, and mortality reduced by over 1%.
- Egg production has been optimised, generating an additional £12,000 per flock in egg sales.

### Background:

Water quality was a challenge, with the borehole at Wern showing as being high in manganese. This had previously been treated with acid, but it negatively affected the gut health of the birds. Therefore, trialling a new product to improve water quality and improving the shed environment to enhance the health of the hens was a focus at Wern.

### Purpose of work:

Improve water and air quality

### Approach:

In May 2020, sensors were fitted and linked to a LoRaWAN gateway to monitor the following every 10 minutes:

- Humidity
- Temperature
- Ammonia
- $CO_2$ levels

**May 2020 onwards –** monthly bacteria swabs undertaken at Wern

**September 2020 –** Pruex stabiliser product sprayed in sheds via an automated Bobi spraying system installed in the corner of the pens

**March 2021 –** convection oven introduced to analyse moisture content in litter and muck on belts

**April 2021 –** additional sensor placed in muck shed to monitor ammonia released from muck after it leaves the shed

Sensors continued to collect data and swabs undertaken until May 2022.

### Outcomes:

Between 26 June and 21 July 2020, ammonia was recorded at 10-15ppm; the aim was to reduce this to at least 5ppm. Ammonia results varied throughout the duration of the project, as the muck was left on the belt for longer than it had been previously. For example, muck would have been removed from the belts after three or four days before the project started, as the weight of the high moisture content muck was too high. When the shed was being sprayed with Pruex bacteria, the muck was able to be left on the belts for up to 10 days, as the moisture levels and weight were reduced, and the ammonia did not build up to dangerous levels within a few days – meaning that it took longer to reach a level that required mucking out.

Ammonia levels were reduced by 75% in the summer months from 20ppm to 5ppm. This has largely been because of a dominance of beneficial bacteria helping to dry up the litter and reduce ammonia emissions and the reduction of muck leaving the shed, due to the reduced moisture content in the litter.

Over a 50% reduction in moisture content has been achieved on the belts, from 78% to 28% moisture content. Further reductions in moisture content were achieved on the litter on the floor/scratch area.

Comparing the last two flocks (one pre-Pruex use and one using Pruex products), mortality rates were considerably lower, reduced from 14.9 to 2.9%, after using Pruex products. The improvement of air quality/reduction in ammonia is highly likely to have had a positive impact on bird health. Eggs produced per bird achieved 371 to 81 weeks of age: 13 eggs per bird above the breed target of 358.

**LOCATION:**
**Welshpool**

**FARM:**
**Poultry**
**486ha in total**
**32,000 Lohmann Brown free-range laying hens**
**Multi-tier Big Dutchman system**
**1,700 Welsh Mountain ewes**
**500 crossbred Mules**
**150-head suckler herd**
**Split block calving**
**Lambing in March**
**Glastir**
**Solar panels / Ground source heat pump / 225kW wind turbine**

## FARM OBJECTIVES

1. To maximise numbers of eggs produced per bird
2. Focus on improving air and water quality
3. To maintain low bird mortalities – maximum of 3% by end of lay

"I found the exercise useful, especially because the device used a Bluetooth feature, offering real-time data collection during the device being placed on belts. This allowed alterations to be made at the time of testing, and the benefits of those alterations were implemented immediately."

## Wern

Osian Williams

**PROJECT 2:** Minimising egg damage during transport from nest box to farm egg grading machine

**PROJECT FACTS:**

Simple adjustments – including tightening belts, reducing conveyor speeds, levelling transfer plates and adding plastic deflectors – can reduce impact on the eggs

**Background:**

Cracked eggs, combined with eggs dirtied by cracked eggs on a transporting conveyor belt, can contribute to a high percentage of eggs classed as seconds. Once eggs are damaged in this way, they are worth considerably less (between 60 – 80 pence per dozen less).

**Purpose of work:**

The aim of the exercise was to identify areas where impact could be reduced, to minimise wastage and graded seconds, increasing egg sale income.

**Approach:**

To measure the potential avoidable damage, the CracklessEgg™ device was used, courtesy of Lloyds Animal Feeds (the farm's feed and pullet supplier). The device is shaped like an egg, and has multiple sensors within it that measure the impact of force an egg experiences through transportation. The device is linked via Bluetooth to a tablet device to give real-time readings as the device is placed on the egg belt. The sensors measure in the unit of G – the force per unit mass to gravity (Figure 28). The CracklessEgg™ device was calibrated before each use to ensure accurate readings.

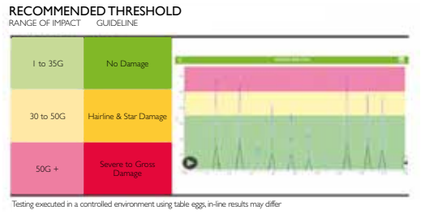



*Figure 28: CracklessEgg™ – device and readings*

An initial run of the CracklessEgg™ on the egg belts, transfer belts and the packing system was carried out on 5 February 2020, to gather a baseline of impact on eggs. At each transfer point, adjustments were made through either tightening of belts, levelling plates or adding plastic deflectors. The device was then placed a second time on the same points to measure improvements made. Due to real-time results being available on the tablet device, some adjustments were made during that day.

The process was then repeated again approximately three weeks later, on 24 February, when birds were 56 weeks of age. Note, eggs were slightly larger and potentially more susceptible to cracking.

**Outcomes**:

The initial reading showed up to 60G, which indicates an area where shell cracking could occur. Issues that can cause this are that the angles of the join are too high, a sagging or uneven belt, or too high a belt speed. It was felt in this situation that the angle was correct; however, there was too much sagging on the belt. This was tightened manually, resulting in a reduction to 40G. It was felt that this reading could be reduced more by removing one of the links from the belt. By the second visit Osian had made a few more minor alterations, which resulted in a decreased impact to eggs of approximately 20G.

Based on an average graded egg price of approximately 86p per dozen (2020 prices), 1% seconds would equate in monetary value to 0.655p/doz. If each bird lays 26 dozen eggs, 1% seconds is equal to 17p per bird, which, over a 32,000 bird unit, would mean a saving of £5,449.60 per flock. There may also be some additional savings to be made in the form of labour, due to time saved grading eggs on-farm from less downtime for clean-up.

This exercise demonstrated that by using a tool such as the CracklessEgg™ device to identify high-impact areas, and then making small changes to these areas to reduce the level of seconds, will create a considerable financial saving.



# Welsh Soil Project - Pan-Wales

PROSIECT PRIDD CYMRU
WELSH SOIL PROJECT

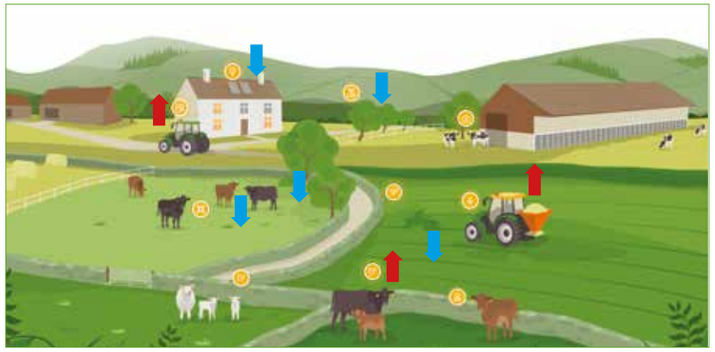
**Background:**

Agriculture is responsible for a proportion of the greenhouse gas emissions in the atmosphere. However, farming systems also have the capability to sequester (remove) carbon from the atmosphere.

**Soils may sequester or release carbon, depending on a number of factors, such as:**

- land use
- management practices
- soil type
- climate

Changes in soil carbon stock occur gradually over several years, and accumulation over time will reach an equilibrium. This makes quantifying a common baseline in soil carbon stocks a challenge. However, measuring the carbon content within soils provides useful figures for benchmarking in the future.



*GHG emissions released to the atmosphere from various sources*

*GHG emissions removed (sequestered) from the atmosphere and stored in the soil/vegetation*

**Purpose of work:**

To determine the soil carbon stock of multiple fields from varying farming systems.

**Approach:**

The detailed data collected as part of this project will be used to provide an insight of current soil carbon stocks across different farming systems. It will also demonstrate how soil carbon stock can differ within a single farming system, as well as between different farming systems, depending on land use and the management practices implemented. Soil samples were extracted from three different depths (Figure 29), up to 50cm where possible, to give a better understanding of soil carbon content at varying depths.

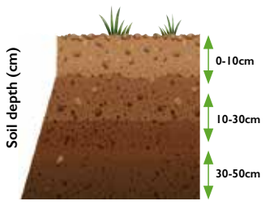


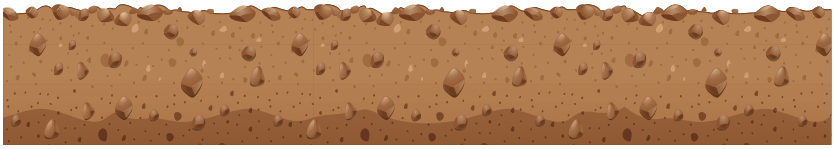

*Figure 29: The three varying depths of sampling soils*

- Five fields under different management practices were selected for soil sampling to identify any differences, Table 13.

*Table 13: Fields sampled under different management practices*

| | |
|---|---|
| 1 | Permanent pasture field (>7 years) |
| 2 | Silage and/or hay field |
| 3 | A field that was recently reseeded (1-7 years) |
| 4 | Grazing only field |
| 5 | Other – e.g. arable, peatland, herbal ley, stock excluded |

# Welsh Soil Project - Pan-Wales

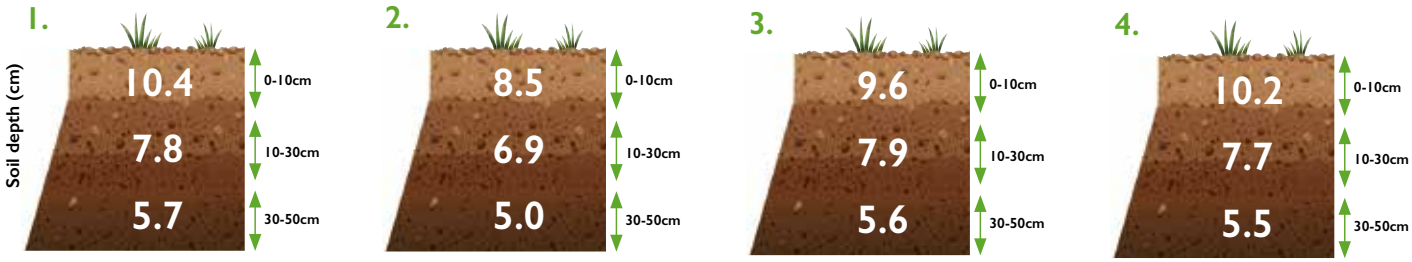


PROSIECT PRIDD CYMRU
WELSH SOIL PROJECT

**Outcomes**:

## SOIL ORGANIC MATTER

*Figure 30: Average Soil Organic Matter content (%) of each sampling depth within each field type.*




## SOIL CARBON STOCK

The Organic Matter results were converted to Soil Organic Carbon (which is the main constituent of Soil Organic Matter). These figures were then used, along with bulk density data (the weight of dry soil within a known volume), to estimate the carbon stock of the sampled soils, expressed in tonnes per hectare.

*Table 14: Average Soil Carbon Stock (t/ha) of each sampling depth within each field type.*

| Soil depth (cm) | Field number | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| 0-10 | 32.4 | 30.8 | 32.8 | 33.3 |
| 10-30 | 57.2 | 50.2 | 60.0 | 58.9 |
| 30-50 | 47.2 | 40.7 | 47.8 | 46.1 |

For more information and to follow the project's progress, please visit ***businesswales.gov.wales/farmingconnect/land/soil/farming-connect-demonstration-network-welsh-soil-project*** or use the QR code below.

Llywodraeth Cymru
Welsh Government

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