



**EIPWALES**

Cydweithio er ffyniant gwledig  
Collaborating for rural success

# EIP Wales

*Collaborating for rural success*

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## European Innovation Partnership (EIP) Wales

### Collaborating for rural success

Welcome to the third and final EIP Wales booklet. In this edition we will be sharing the results and stories from the remaining 15 projects the programme has funded since 2017.

On the 5th of May 2023, EIP Wales held a conference at Gregynog Hall, near Newtown to celebrate six years of funding on-farm projects and to mark the culmination of the programme. A leading figure in Welsh agriculture, Professor Wynne Jones OBE, was one of the speakers at the conference and said that the success of EIP Wales has highlighted the value of a ‘bottom up’ approach to agricultural research, which he described as “priceless”.

*“We often see the challenge of getting the ‘push’ by scientists to join up with the ‘pull’ of farmers but EIP Wales and Farming Connect have done a fantastic job in establishing that linkage, by bringing people together to address common problems that demand a solution,”* he told delegates attending the event.

EIP Wales manager Owain Rowlands said the initiative had encouraged collaboration between farmers, researchers, advisers and others.

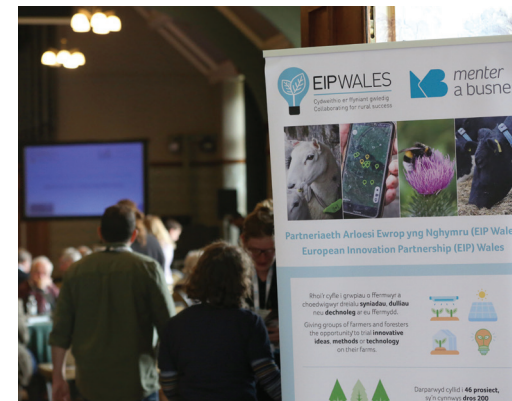
*“Bringing farmers and others who work within the agricultural sector together has provided an excellent opportunity to draw from different experiences and to introduce new methods whilst tackling problems,”* he said.

Mr Rowlands added. *“Innovation is only successful if it is widely taken up and EIP Wales has highlighted the importance of farmers being directly involved in putting research into practice.”*

Collaboration with the Knowledge Exchange Hub at the Institute of Biological, Environmental and Rural Sciences (IBERS), Aberystwyth University, assisted farmers in ensuring their projects were armed with the latest knowledge.



From left: Geraint Powell (Cabalva Farm), Matt Swarbrick (Henbant Farm), Hugh Martineau (Map of Ag), and Dr Will Stiles (IBERS, Aberystwyth University) discussing regenerative agriculture in one of the panel sessions.



But Mr Rowlands said it would not have been a success without the farmers who had been key participants, and the innovation brokers and facilitators who had helped bring those projects to life. *“It has been a great experience seeing such a range of innovative and ambitious ideas coming from farmers. Welsh agriculture has a great deal to be proud of,”* he said.

*“Despite the present challenges and changes facing agriculture, I think it’s important to remember that this also presents an opportunity to develop new ways of thinking and working, as EIP Wales has proven.”*

Some of the topics within these projects, including the use of technology in farming, animal health and welfare, horticulture, and environmental sustainability were considered in a series of panel discussions at the conference.

Keynote speakers at the conference were Tim Bennett, chairman of the Centre for Innovation and Excellence in Livestock (CIEL), and Powys farmer Keri Davies, who is piloting changes in agricultural practices aimed at improving farm efficiency and resilience.



Professor Wynne Jones OBE.

Further information and resources on all the EIP Wales projects can be found using these QR codes.

EIP Wales Booklets – Summarising the results from all 46 projects.



Watch the EIP Wales Highlight Video.



# Developing a blueprint for controlling malignant catarrhal fever (MCF) in bison, buffalo, and cattle in Wales



A bison cow and calf at the Rhug Estate.

When organic farmer Lord Newborough decided to add bison to the farming operations at the Rhug Estate, near Corwen in North Wales, his farm manager did some research and travelled to Ireland to buy a dozen in-calf heifers and a bull.

The bison became a popular attraction for passing motorists travelling on the nearby A5 and fast forwarding several years, the herd has been at the centre of an ambitious EIP Wales project alongside the Buffalo Dairy in Llanon, Ceredigion to investigate a disease that can be fatal in farmed bison and buffalo.

In Wales and the wider UK, some producers have found a ready market for bison meat as it is a healthier red meat alternative to traditional beef products, being lower in fat, cholesterol, and sodium. Deadweight prices for bison are also approximately twice as much as for beef cattle.

However, bison are challenging, not only due to their temperament and sensitivity to stress, but also their increased susceptibility to malignant catarrhal fever (MCF), which is considered a disease-limiting factor to successful production.

## What is MCF?

In the UK MCF is caused by the virus OvHV-2, and can affect many species including cattle, bison, water buffalo, deer and yak. Sheep are considered the main reservoir host, but in bison the infection can lead to sudden death due to a rapid onset of infection.

The EIP Wales project investigated the possible steps farmers can take to control MCF, which is currently lacking within this niche sector.

Blood samples were taken from bison, buffalo, cattle and sheep on each farm to test if they had been exposed to OvHV-2.

The blood, along with pooled faecal samples, were also tested to see whether bison and buffalo had been exposed to other infectious disease or parasites that could potentially increase their risk of developing MCF.

A new vaccine against OvHV-2 was used on the bison at Rhug which were known to have an MCF problem to assess whether it was a practical option for controlling MCF on farms.

Dr Joe Angell, of Wern Vets, who worked with the farmers, explained how the vaccine, which was developed by molecular virologist Professor James Stewart at the University of Liverpool, has shown encouraging early signs.

*“Professor Stewart has been working on MCF for quite a while and agreed to work with us to see if we could come up with other solutions to control the disease,”* he said.

The SA-MCF vaccine used in this project was experimental and is not available for use on other farms at this stage.

It was not possible to say from the results of this project whether the vaccine prevented infection or disease in the bison. However,

the evidence gathered is promising and it will hopefully encourage more farmers to explore bison and buffalo farming in Wales as a diversification option and with further work, commercial deployment of this vaccine could occur.

Additional recommendations for farmers seeking to establish or further develop bison or buffalo herds identified as part of the project include:

- Establish the herds as far away as possible from sheep, with at least a 3km distance from the nearest sheep where possible.
- Optimise the nutrition of the animals and ensure an appropriate forage-based diet with supplementation of energy, protein, and minerals based on a sound, evidence-based approach as well-nourished animals are likely to be more resistant to infectious diseases.
- Stress will increase susceptibility to diseases such as MCF. Combining necessary events e.g., parasite control, trace element supplementation and statutory testing will minimise the number of stress events experienced by the bison.
- Use appropriate downstream monitoring to ensure optimisation of animal nutrition and adjust as necessary.
- Manage parasitic diseases carefully, as even adult animals may have high parasite burdens – so regular pooled faecal egg counting is recommended to detect any increase in parasitism early.

Watch this video to see the Bison herd at Rhug Estate.



Learn more about this project.





## Improving horticultural yields with Molinia biochar and sheep manure/wool based soil amendments

Above: Tony Davies, William Roberts, Owain Rowlands and Oliver Kynaston.

This EIP Wales funded project showed how applying biochar charcoal mixed with sheep's wool compost to soil can increase vegetable production by an average of 14.8%.

Biochar, a type of charcoal produced during pyrolysis and known to increase carbon sequestration, was rolled out on four sites across Wales over two growing seasons to assess how it impacts vegetable performance.

Both the biochar, made from Molinia grass, and the compost were produced by Tony Davies on his farm Henfron, near Rhayader.

The trials involved crops of radish, basil, courgettes, maize and cabbage and 14 experiments were conducted with each of the applications at three different rates in comparison to control plots.

### What were the effects of the different mixtures used in the project?

- Biochar alone, applied at 10t/ha, increased crop performance by 8.2%.
- Biochar and wool compost, applied at 30t/ha increased crop performance by 14.8%.
- Wool compost, applied at 30t/ha, reduced crop performance by 7%.

Oliver Kynaston, a consultant with expertise in this area, oversaw the trial and analysed the results, said: *"Adding biochar to the soil during these trials had a moderate positive impact when averaged across all sites."*

*"The performance of biochar and biochar compost was greater in the second year of the project, indicating biochar remains in the soil and could provide a stable structure for beneficial fungal and bacterial communities,"* said Mr Kynaston.

*"When growing conditions are quite poor, for instance in the heat of summer when there is not quite enough moisture, the crops grown with biochar and compost performed twice as well because it improved the water holding capacity of the soil."*

*"It has real benefits for acidic soils and also works very well in sandy soils that don't have great water holding properties."*

William Roberts of Cae Newydd, Upper Brynamman was one of the growers involved in the project. *"This trial has shown me that biochar could be an input to consider going forward when it is more readily available and affordable,"* he said.

Mr Roberts used it to grow leafy green cabbages in soils with existing high levels of organic matter and a neutral pH.

Mr Kynaston said the high quality soil may explain the relatively small impact of the biochar applications on crop yield – application of biochar alone resulted in a slight increase in yield and biochar compost in a moderate increase.

The best results achieved during the trial were in globe radishes grown in pots in poor quality hill soil amended with biochar and compost.

The results in both years showed that adding either biochar or compost improved yields significantly compared to the control. In the second year, the highest application of biochar, at 40t/ha, produced a yield difference of 91%.

The poor quality soil was the most obvious explanation, said Mr Kynaston – soil analysis revealed a very low phosphate (P) concentration in the soil and biochar is known to be a source of P, depending on the input substrate.

Biochar is also known to have a liming effect which may be beneficial to crops growing in very acidic soil, he added.



The different types of soil amendments being added to the trial plots at the start of the project.

Learn more about this project.





## Opportunities for market diversification and increased farm resilience with exotic vegetables and edible flower production in Wales

Left: Purple and grey perilla. Above: Philip Handley of Mostyn Kitchen Garden.

An increasing appetite for new and diverse flavours in cuisine amongst UK consumers is providing opportunities for Welsh growers to expand their product range and boost income.

Whilst the use of micro salads, edible flowers, and unusual vegetables such as Okahijiki and Perilla have been popular within fine dining and high-end restaurants for some time, enthusiasm is now growing more widely.

Although these niche crops have been grown successfully in different countries, there is no agronomic advice available specific to Welsh climate, particularly regarding fertiliser provision, crop management, and pest/disease control.

Philip Handley of Mostyn Kitchen Garden, which is based at Mostyn Hall, North Wales, was one of the two growers involved, and said: *“This project looked at a few of the more unusual plants that could be grown in Wales for supplying to restaurants and food producers.”*

*“There is a demand for unusual plants to add to salads, garnishes, and decoration. The project showed that it is possible to produce a varied range of high value crops on a small area with relatively low costs.”*

*“A grower could use these crops to add another range to an existing business or it could provide an opportunity to diversify.”*

### Some of the novel crops grown during the project included:

- Okahijiki (Seaweed on land) – leaves eaten fresh as a salad vegetable, traditionally eaten with sushi, but can be used as an accompaniment to fish or chicken.
- Perilla – a mint flavoured herb, often used as an addition to curries or tempura.
- Oyster leaf – used as a garnish or addition to curries and tempura.
- Callaloo – similar to spinach, callaloo is common in Caribbean style dishes, as well as in curries and stews or as a salad or leaf garnish.
- Edible flowers – including viola and courgette flowers.

Over three growing seasons, a range of information was collected from sowing through to harvest.

Key findings of the project indicated that these crops could be adapted for production in Wales, with the niche nature of crops potentially being offset by the higher price ranges which can be achieved.

Product	Size	Indicative Price
Agretti	Small bunches (50g)	£2-£3 per 50g
Perilla	Small bunches (10-20 leaves)	15p-30p per leaf or c. £8 per 10g
Oyster Leaf	Small bunches (30-50g)	£2-£5 per 10g
Callaloo	Small bunches (50g)	£2-£3 per 50g
Ice plant Leaves	Small bunches (10-30 leaves)	£3-£5 per bunch
Viola Flower	Small punnets of 25-30 flowers	£6-£8 per punnet, £1/g
Ice plant Flower	Small punnets of 15-20 flowers	£4-£6 per punnet
Begonia Flower	Small punnets of 15-20 flowers	£6-£8 per punnet
Courgette Flower	Small punnets of 5-15 flowers	£2-£3 per flower

While these crops must be grown to the highest quality standards, they can achieve these price ranges when sold directly to consumers.

Additional conclusions stressed the importance of developing a marketing space for the exotic plants, as some growers may need to support their customers in achieving the best use of the products due to the current novelty of the crops. This could include recipe cards, social media posts, or promotion through marketing channels.

Learn more about this project.





## The Welsh Farmland Bird Initiative: Overwinter feeding of farmland birds to reverse biodiversity decline on productive pasture-based farms

From left: Antony Griffith and Matt Goodall pictured with a supplementary bird feeding bucket, and cover crop behind.

**Two Welsh farms have seen a sixfold increase in the populations of farmland birds visiting their farms since growing seed-bearing cover crops and providing feeding stations containing supplementary seed.**

The EIP Wales project, was run in conjunction with the Game and Wildlife Conservation Trust (GWCT) on two farms, and has sought to help reverse the decline of farmland bird numbers in Wales.

The three-year project has now concluded and shows dramatic results.

Chaffinches, reed buntings, green finches, and linnets – a species on the red list of Birds of Conservation Concern - flocked to the farms after seed-bearing cover crops

were grown, along with feeding stations providing supplementary seeds.

Higher numbers of insects, including butterflies, were found in the cover crops – which helps provide feed for the birds and their chicks in the spring and summer.

Farmland bird populations have significant ecological value and are recognised as one of the most important indicators of ecosystem quality and farming practice sustainability.

The two farms involved in the project – Tŷ Newydd Farm, an organic dairy farm in Trefnant, Denbighshire, and Gilar Farm, a hill sheep and beef farm near Pentrefoelas – were chosen as representatives of the type of farms found across Wales.

A combined total of 5.5 hectares (ha) of wild bird seed mix cover crops were grown across the two holdings and supplementary feeding buckets filled with seed placed near the crops to provide sufficient food during the so-called ‘hungry gap’ from December to April, when the seed in the cover crop has been eaten.



Aerial view of the cover crops at Tŷ Newydd Farm.

The hope was that the feeding stations would decrease winter mortality and ensure a higher adult breeding population in the following spring.

At the beginning of the project careful consideration was given as to which cover crop to use on each farm and their placement. These cover crops were designed to meet the circumstances of each farm and deliver over-winter food for seed-eating farmland birds and provide cover

from predators and adverse weather for a host of other wildlife.

Surveys were taken throughout the project to record bird and pollinator numbers to analyse the effects of these approaches.

The project succeeded in showing that these simple measures can support bird conservation whilst also being able to fit in with commercial livestock farming.

Antony Griffith of Tŷ Newydd Farm said: *“Biodiversity is an important part of being a custodian of the land and it’s a real concern across Wales as we’ve seen increasing industrialisation of the countryside and pastures being grazed out.”*

GWCT Advisor for Wales, Matt Goodall said the results had exceeded expectations.

*“Some sceptics might suggest that we are attracting birds from other areas to these sites, that we are not seeing an increase in populations, but even if that was the case those birds are surviving the winter rather than dying and are stronger going into the breeding season.”*

*“However, our breeding bird surveys show that the crops and feed do make a difference to the populations on the farms themselves. What had been unexpected was the doubling of breeding bird numbers so quickly and within the life of the project,”* he adds.

Watch Ant and Matt discussing the project.



Learn more about this project.





## Targeting anthelmintic use in sheep

The number of ewes that need to be wormed around lambing time could be significantly reduced, according to the results from an EIP Wales-funded project.

Involving five commercial sheep farms across Wales, the project showcased clear links between an increased worm burden in ewes before and after lambing with low body condition and nutritional stress.

The need to control the volume of worms contaminating pasture has long been a reason why farmers have wormed every ewe during the lambing period, but the project has suggested this belief is mistaken.

Faecal egg count (FEC) samples, taken from six weeks before to six weeks after lambing, suggested an ewe's immunity to worms is much more to do with the stress on them when their nutrition is under the most pressure.

### Why are wormers used at lambing time?

Project specialist and independent sheep consultant Lesley Stubbings said: *"There is the perception that it is because it does the ewe good. This is the bit that we must try to separate from. It is really all about reducing the number of worm eggs the ewes drop on to pasture in their dung, which then become a challenge to lambs later in the season."*

*"Fit adult ewes have immunity to worms by the time they are 12-18 months old, with the exception of the barber pole worm."*

*"They are still ingesting worm eggs but they have a nice relationship with them as in they will allow a few to exist and choose which to stay in their gut and which to shed."*

The project showed if an ewe is not under nutritional stress, she does not need to be wormed, with FEC samples taken during the study showing they are not shedding large numbers of eggs.

This data also covered leaner ewes, with an estimation that around 80% of pasture contamination is caused by as few as 20% of ewes.

Monitoring body condition score (BCS) will also allow farmers to identify which ewes to treat, leaving a higher proportion untreated and maximising effectiveness and saving treatment costs for those that need treating.

Ally Ward of Zoetis, who helped to administer the project, said: *"Another key takeaway from the project is that if ewes are treated with long-acting moxidectin 2% wormers, some must be left untreated – 10% is the absolute bare minimum and this project shows that in many cases the proportion that require treatment is much lower."*

*"Year-on-year use of long-acting moxidectin in ewes around lambing is not advisable in a flock, and simply rotating it with other wormer groups within a season is not enough,"* she explained.



From left: Eurion Thomas and Serian Evans (Techion), Ally Ward (Zoetis), sheep consultant Lesley Stubbings, Tony Little (Sustainable Farming Consultancy) and Heledd Dancer (EIP Wales) who were all involved in the project.

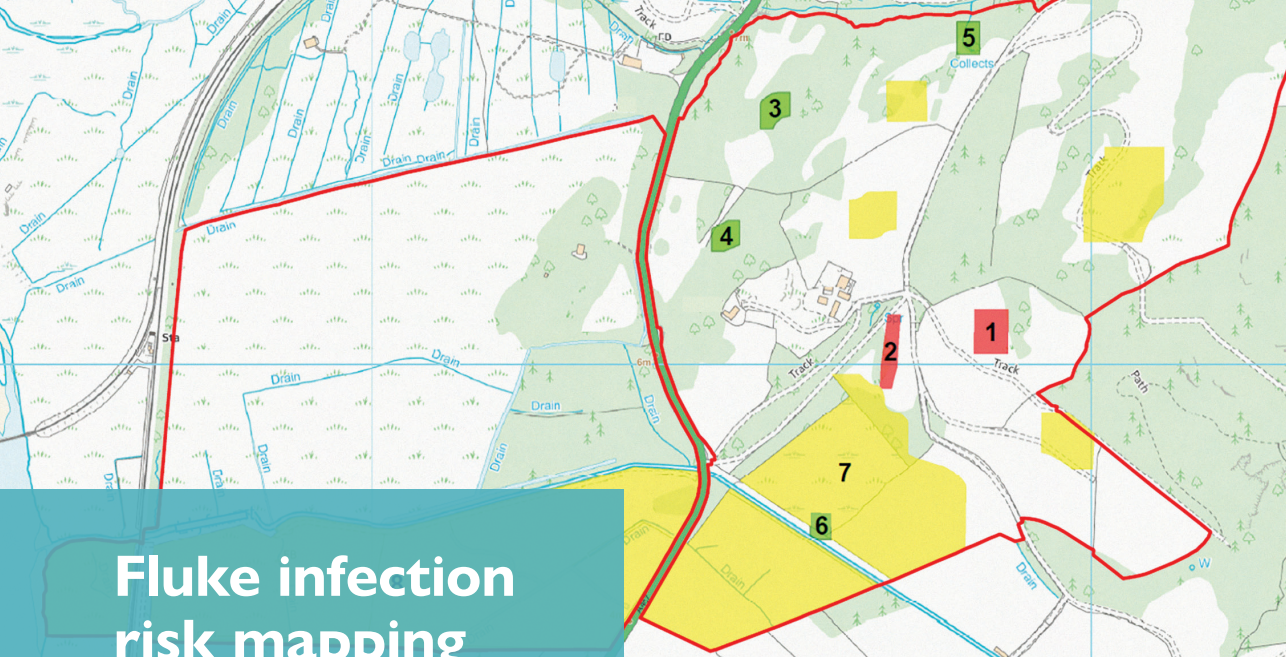
### Recommendations to farmers:

- Use BCS and FEC to identify which ewes to treat and when
- Observe a high level of accuracy when dosing through weighing animals, ensuring equipment is correctly calibrated, and using best practice.
- Analyse forage to ensure ewes get the correct level of nutrition and work out what contribution of the ewe diet is coming from forage.
  - On several of the farms tested as part of the project, FECs increased when ewes were short of grass.
  - Only minimal compound feed is needed if she is getting sufficient nutrition from forage, and compound oil content should be no more than 4 to 5%.
  - Ash and fibre should be less than 10% and the crude protein quality and quantity as required by the ewe according to stage of pregnancy and forage content.
  - Although the list of ingredients on the label does not state inclusion rates, molasses is a good barometer for where each sit on the list as this is usually present at 5-6%.

Learn more about this project







## Fluke infection risk mapping using eDNA to inform the development of sustainable control measures

Farmers, vets, and researchers teamed up for a project to tackle liver and rumen fluke by examining environmental DNA in water sampled across six farms.

The aim of the project was to investigate the use of infection risk maps to help control fluke, a parasite which seriously impacts animal health and welfare and costs the UK cattle industry an estimated £23m annually and around £3 to £5 per infected sheep.

The mud snail (*Galba truncatula*) is the intermediate host for liver and rumen fluke, meaning that these flukes are reliant on

Example of a fluke risk map produced. Red: eDNA positive area. Green: eDNA negative area. Yellow: lack of water to sample, suspected fluke risk area.

this specific snail to be able to develop and multiply on pasture before infecting sheep and cattle. It is only areas on farms where this snail lives that fluke can infect livestock.

The snail requires moist and muddy conditions over the summer months, however, many factors influence their distribution. Identifying where these snails reside on pasture, and subsequently where fluke infection risk areas occur, is challenging, especially as the snails are less than 1 cm in length and are well camouflaged within mud and water. To alleviate this, the project utilised Aberystwyth University's environmental DNA test, which can detect the presence of the mud snail on pasture by finding traces of its DNA.

The project was a cooperation between a group of farmers in Ceredigion who have all experienced problems with fluke, IBERS (Aberystwyth University), the Ystwyth Veterinary Practice in Aberystwyth, and funded by EIP Wales.



Examples of fluke risk areas on project farms. Left: an elongated mud snail habitat created by a continuous flow of water from a spring head at the top of the field. Middle: Cattle access to a drainage ditch led to poaching on the edges allowing mud snails to colonise. Right: tyre ruts allow water to pool and persist during summer which created a mud snail habitat.

Using the eDNA analysis tool, infection risk areas were identified on each of the six farms and guidance was given to the farmers on ways to minimise infection risk in these areas.

Further risk areas with limited intervention options were also identified, however, as livestock were also tested for fluke infection, the farmers received insight into fluke egg pasture contamination patterns. They were then able to adapt their grazing management, fluke testing and treating protocols to limit fluke egg contamination on these mud snail habitats.

By limiting fluke egg contamination, reduced fluke infections of mud snails is seen, which subsequently reduces fluke infections of livestock the following Autumn.

The project confirmed the complex nature of liver and rumen fluke infection of livestock. In addition, the project confirmed that eDNA sampling could be used as a tool to identify high fluke risk areas on farm. By identifying fluke infection risk areas

fluke control strategies may be optimised especially if they are applied in conjunction with sustainable use of flukicides.

It is advised that farmers develop a tailored fluke control plan in consultation with a vet. This ensures that fluke infections are detected and treated when necessary, with appropriate anthelmintics.

Fluke risk will vary from year to year, and from farm to farm, and regular adjustments to treatment schedules may be needed. Following a vet guided fluke control plan can limit resistance development by ensuring that triclabendazole is not overused in a flock by tailoring the use of other anthelmintics at appropriate times, and by guiding appropriate quarantine treatment of bought in animals.

Learn more about this project.





## The impact of herbal leys on the health and performance of grazing lambs

This project set out to investigate whether herbal leys affect the health and performance of growing lambs, when compared to a more conventional ryegrass and clover pasture.

Herbal leys, also known as multi-species pastures, can often include a mixture of up to 17 species of grasses, legumes and herbs.

Farmers are increasingly looking to the use of herbal leys within their grazing systems to bring benefits to forage quality and quantity, livestock health and soil fertility. Some species, such as birdsfoot trefoil and chicory have anthelmintic properties and other species are higher in micronutrients compared to ryegrass and clover.

The project, involving three farmers from Ceredigion and Carmarthenshire, aimed to

assess whether herbal leys, in comparison to a more conventional ryegrass and clover ley, has any effect on:

- Worm burden in grazing lambs
- Lamb performance

On each of the three farms, one field was split into two plots of equal size (ranging from 1ha to 3ha per plot), with one plot sown with a conventional ryegrass-based ley and the other with a herbal ley.

Two standard 'off the shelf' seed mixes were used. The herbal ley used was a mix of 50% perennial ryegrass varieties and other species

	Average FEC (2020)		Average FEC (2021)		Average FEC (2022)	
	Conv	Herbal	Conv	Herbal	Conv	Herbal
Site 1	391	230	445	323	234	183
Site 2	962	326	355	365	485	243
Site 3	276	240	218	187	260	164

Average FEC levels of the two lamb groups on each farm, one group grazing the herbal ley and the other grazing the conventional ley.

such as chicory, plantain, yarrow, timothy and white clover. The conventional grass mix used was a more common perennial ryegrass, timothy and white clover mix.

A worm burden was also evenly introduced onto the new pasture. The two plots on each farm were then subdivided into quarters to be rotationally grazed, with lambs grazing the plots from weaning to the end of October, grazing from 2500 kgDM/ha down to no lower than 1500 kgDM/ha.

A sample of 10 lambs from each trial plot were weighed and faecal sampled across the three farms every two weeks throughout the period.

Plots were measured for dry matter yield throughout the growing season and fresh grass samples were taken to assess the nutritional value of the two different leys. Pasture larval counts were also taken.

Finally, the data from all plots across the three farms were analysed and compared to assess the benefits and disadvantages of both leys in terms of animal performance, health, pasture production and quality.

Grassland consultant, Nigel Howells, who led the project, said: *“On average across all farms the faecal egg count (FEC) of the lambs grazing the herbal ley was 30-65%*

*lower compared to the lambs grazing the conventional ley.”*

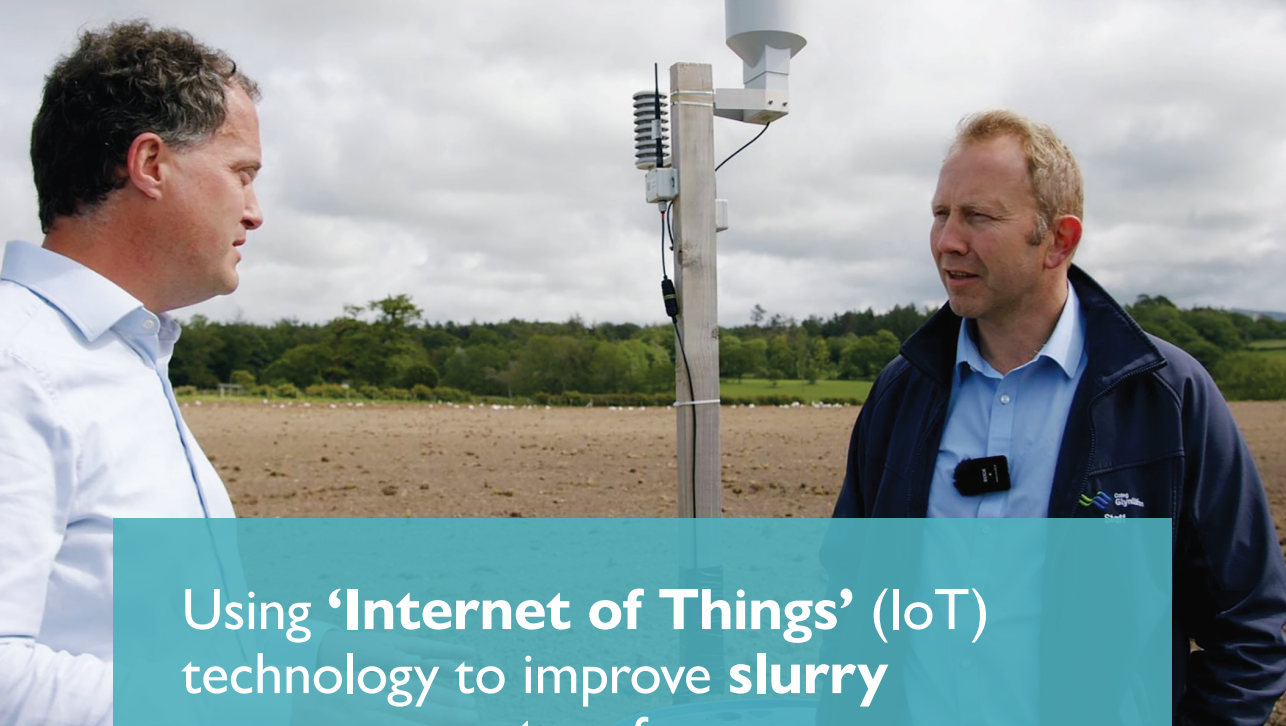
*“The total dry matter per hectare of pasture grown by the herbal leys was comparable to the conventional pasture overall, with herbal leys responding better in dry conditions.”*

*“Lamb daily liveweight gains were similar on the herbal and conventional plots, with the herbal pasture lambs having slightly better growth rates in 2022, probably due to the herbal leys dealing with the drought conditions better than the conventional leys.”*

*“It would be beneficial when using herbal pasture to have a 30+ day grazing rotation, as the 27/28 day rotation which the project was working on seemed to affect plant population by year 3, resulting in a reduced herbal population,”* he added.

Learn more about this project.





## Using 'Internet of Things' (IoT) technology to improve slurry management on farms

Left: Geraint Hughes of Lafan Consulting, the EIP Wales Innovation Broker who facilitated the project, and Rhodri Owen, Farm Manager at Coleg Glynllifon. Pictured in front of the atmospheric temperature and soil moisture and temperature sensors.

### Three farmers in north Wales, all keen to make better informed decisions on when to apply slurry to fields, took part in this project to test a selection of sensors to help improve on-farm management.

The aim of the EIP Wales-funded project was to use 'Internet of Things' (IoT) technology to improve slurry management on farms, with the technology having the potential to help the industry as future pollution prevention regulations are introduced in Wales.

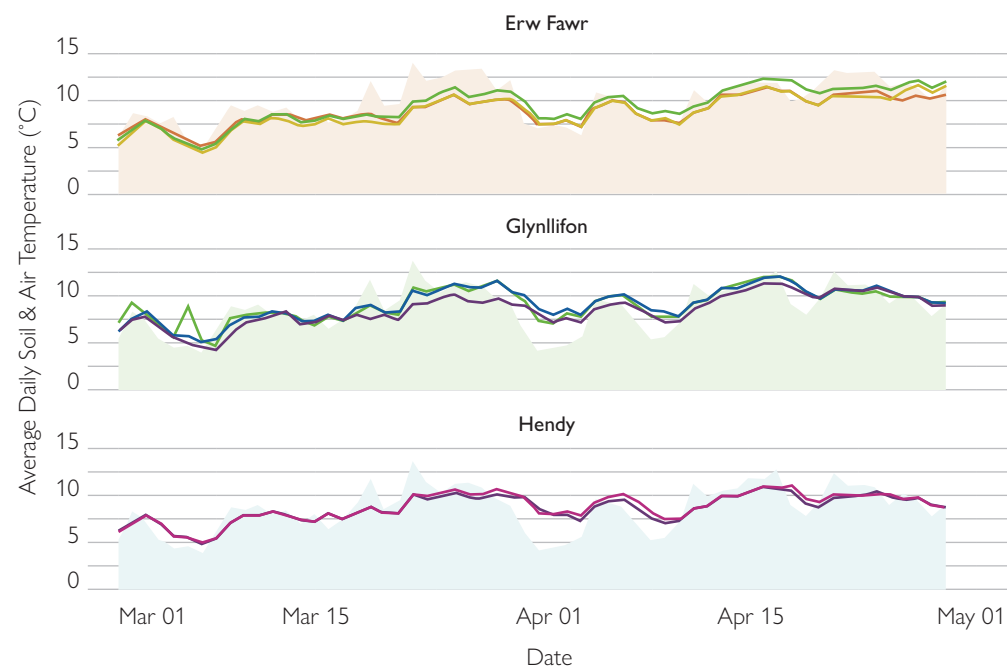
#### What sensors were used?

Long-Range Wide Area Network (LoRaWAN) sensors can transmit wireless messaging over a long-range with minimal power, making it suitable for remote monitoring with high battery endurance. On each farm soil moisture, soil temperature, air temperature and slurry pit level sensors were installed.

The data collected, along with the immediate weather forecast, fed into a web based dashboard providing the farmer with information on whether field conditions were suitable or not for applying slurry.

One of the participating sites, Coleg Glynllifon at Llandwrog, had sensors located in three fields with different soil characteristics.

Farm manager Rhodri Owen said: *"Usually we would make a visual decision, but this allows us to make more solid decisions based on real data."*



Field soil temperature (line) with air temperature (shaded) over March and April across the three project farms. Soil temperature demonstrates a lag being slower to both warm up and cool down than the air temperature which influences it.

Rhodri said the dashboard shows a graph recording soil moisture, air temperature, and soil temperature clearly, and that it is possible to set alerts on smart devices, such as when the slurry pit is getting too full for example.

The project also allowed farmers to use the soil temperature sensors to make more timely decisions on when to apply nitrogen fertiliser at the start of the season when using the T-SUM 200 model.

The project also noted that different soil types have different water carrying capabilities and as a result saturate at different soil moisture levels, with further work needed to determine exactly what the observed soil moisture level would read when a particular soil type is saturated.

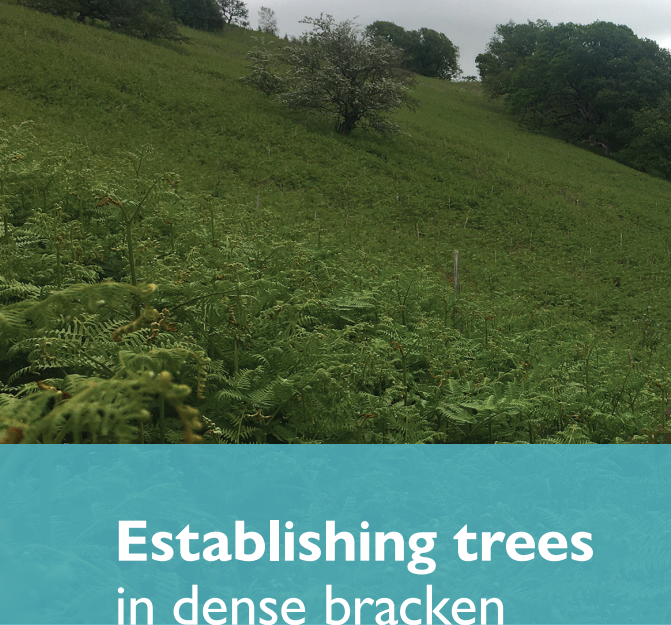
Legislation recently set out by the Welsh Government lends further importance to this project. It has helped provide a deeper understanding of how technology can provide data to inform better decision making, together with fostering a closer collaboration between farmers and IT technical expertise to further develop the emerging Agri-tech sector in Wales.

Watch Geraint Hughes and Rhodri Owen discussing the IoT technology at Glynllifon.



Learn more about this project.





## Establishing trees in dense bracken



The slope of one of the project sites, with one of the planted birch trees in the foreground.



The remote controlled Robocut machine with a rotavator attachment.



The mini digger Mini Tilla rotavator attachment.

The Welsh Government has proposed the planting of 40,000 ha of woodland as part of its climate-change strategy. Bracken land provides an obvious location for much of this woodland as it has a low agricultural value and is generally not considered to be of great conservation value. Moreover, soils in which bracken grows well are good for tree growth.

However, bracken is an aggressive plant that can quickly dominate large areas of land if not controlled, causing shading due to its dense canopy, whilst at the end of the growing season, the collapsing fronds tend to flatten and bury young trees.

This promoted Peter Jackson, woodland specialist, and two farmers from the Cambrian Mountains to take part in this two and a half year EIP Wales funded project to investigate different approaches to controlling bracken that avoid aerial herbicide (Azulox) treatments. This approach can be damaging to the environment and is not an available option in circumstances such as on organic land, near watercourses or water supplies, and near sites for nature conservation.

As an alternative to Azulox herbicide, the project compared the following mechanical cultivation techniques for their effectiveness in reducing bracken growth sufficiently to allow the successful establishment of trees:

- Mini digger to cut shallow benches
- Mini digger with a cultivator attachment
- Crawler tractor with a cultivator
- Forestry scarifier
- Robocut machine with a cultivator

Around 3000 saplings of the following four species were then planted across both sites:

- Sessile Oak
- Downy Birch
- Rowan
- Sitka Spruce

Alternative techniques of post-planting weeding were also carried out for comparison, and these techniques included strimming and trampling by foot.

Despite the first year of the project being hampered by heavy rainfall and COVID-19, some key findings indicated tree choice may be key to the successful establishment of new woodland on bracken covered areas.

The most resilient of the four species was Rowan followed by Birch, with the project concluding these species should be favoured when planting in challenging bracken sites.

However, the projects concluded overall that cultivation of bracken is not likely to be a promising option, with a large majority of sites likely to be too steep for most equipment to be sufficiently utilised. 50% is probably the maximum slope gradient for safe working.

Additionally, the cultivated strips would have to be wide to avoid the impact of vigorous growth of adjacent bracken, with complete ploughing or rotavating the site the most

practical option which could lead to erosion and other environmental problems.

Planting into dense bracken (using canes and spirals) in the absence of cutting or trampling was also found to have a poor rate of establishment, with significant cumulative losses continuing for at least three years after planting.

The pushing over and smothering effect of the bracken was found to be a greater problem than the direct shading, as trees planted into bracken without any support were unlikely to survive.

However, the project did find that the impact of the timing of strimming and/or trampling on tree survival is a topic of research that could be worth looking at in the future.

Learn more about this project.






## Improving fertility and calving rates of dairy herds in South West Wales through a method of early pregnancy diagnosis using pregnancy specific protein B (PSPB)

PSPB is a chemical that is produced by a pregnant ruminant animal, and provides a reliable predictor of pregnancy.

In this EIP Wales funded project, four dairy farmers in Carmarthenshire, with a total of about 1,700 cows, worked with Dr Sotirios Karvountzis of Mendip Vets, Llandeilo, to investigate whether PSPB can be used as an early indicator of pregnancy in dairy cows, within 30 and 120 days post-service.

Previous studies in Idaho in the US have indicated that the PSPB concentration in blood serum is more reliable for testing purposes than those in milk within this period.

AHDB reports poor fertility on farms currently equates to a national average of 3.5p/litre in increased costs due to long calving intervals and failure to conceive. Early recognition of infertility in a dairy herd can lead to timely and appropriate treatments in consultation with the farm's vet.

Earlier pregnancy diagnosis (PD) by testing PSPB in blood could provide a potential improvement in conception rates, which would reduce the calving interval on farm and improve milk yields as a result.

### What did the project involve?

- All breeding cows were split into two random groups, with one group pregnancy diagnosed using ultrasound scanning and the other pregnancy diagnosed using PSPB.
- Farmers continued with their usual breeding programme on farm, with the cows in the PSPB group blood sampled by a vet as close to 28 days post service as possible.
- Following 12 months of testing, the data from all four farms was analysed and a comparison was made between ultrasound scanning and PSPB, as well as a cost benefit analysis.

*"PSPB was found to be 94% accurate and ultrasound was 95% accurate in predicting the positive result. Also, PSPB was 87% accurate and ultrasound was 86% accurate in predicting the negative result. The difference between these results was not statistically significant,"* said Dr Karvountzis.

There are advantages and disadvantages to both methods of pregnancy diagnosis. PSPB allows for a trained farmer to collect the samples at any time that suits their schedule, and that of their cows. It can be implemented as part of the weekly management task, similar to foot trimming, minimising the disruption to the animals' routine. Once the PSPB results are returned from the laboratory, those that tested negative can be presented to the vet. The vet can then ascertain why they are unable to conceive and administer appropriate treatments.

As for the disadvantages, the collection of a blood sample falls under the remit of the Veterinary Surgeons Act. Therefore, the person who harvests those samples

must be trained in the procedure by their own vet. Secondly, although PSPB predicts a pregnancy result relatively accurately, it cannot ascertain the length of the pregnancy (and therefore works best with a known service date), twinning rate or be used for gender determination.

Hywel Watkins, who farms at Pantglas, Llanfynydd, near Llandeilo with his brother Rhys and mother Janet, is one of the four farmers taking part in the project. The family run a herd of 370 purebred Holsteins that are fed a total mixed ration (TMR) diet and operate a housed all-year autumn calving system. On average, each cow produces 45 litres of milk per day.

*"PSPB testing benefits our business, as it's stress-free for both us and the cattle. Cattle now do not have to wait and it's more convenient, and as accurate as scanning,"* says Hywel Watkins.



From left: Dr Sotirios Karvountzis, Rhys Watkins with his brother Hywel Watkins and mother Janet Watkins of Pantglas farm, Llanfynydd, Llandeilo.

Learn more about this project.





## An analysis of the use of a computerised mechanical weeder in small scale horticultural operations

Hand weeding, where labour is available, is currently costing as much as £1-2,000 per Ha and may need doing twice or more per year. Herbicide options on conventional systems would cost approximately £100-200 per Ha, but there is increasing pressure within the industry to reduce chemical inputs.

Mechanical weeders are commonplace in larger operations, but their effectiveness and viability in smaller scale situations had not been analysed until now. The issue is pressing as there is currently a shortage of skilled labour available in the agricultural sector.

This EIP Wales-funded project sought to analyse the impact of computerised robotic multi-row weeders on two small scale horticultural systems compared with the current methods of hand hoeing.

One of the farms in the project is organic while the other was keen to look at alternatives to a conventional pesticide programme, so a system which is not reliant

on the use of chemicals is essential to the long-term success of both operations.

The cost of hand weeding is a challenge to the Small and Medium Enterprises (SME) organic growers as popular vegetables including carrots, parsnips and the allium family are all slow germinators and poor competitors to weed pressure. However, without these basic crops it is difficult to offer a good range to market to customers.

### Project results

- Hand weeding took 16 minutes on average for a 30m length of one bed width of leeks, compared to only 21 seconds, for the same plot size with the



Above: The Steketee EC-robotic weeder used in the project.



The vision guidance system of the Steketee weeder.

robotic weeder. Hand weeding can cost as much as £16 per hour.

- Robotic weeding using vision-guided systems normally used in broadacre crops proved extremely effective.
- The robotic weeders tested in this project (Steketee EC-weeder with inter-row attachment) would be beneficial to small-scale horticultural growers to aid their weed control requirements, but the initial purchase cost needs to be considered carefully.
- An adaptable spreadsheet was produced which outlines the annual cost of vision guided weeders at three different price points. Use the QR code to access this.

- The crop rows need to be precisely planted and extremely straight to ensure there is no crop damage as the tines get very close to the crop,
- On one of the sites the grower was confident the use of the Steketee mechanical weeder should reduce the need for one of the post-emergence herbicide applications as well as increase the overall efficacy of weed control.

Learn more about this project.



# Tackling Scab – a farmer led approach



Collaboration between a group of neighbouring farmers in west Wales is helping to tackle scab – a serious problem which costs the Welsh sheep industry around £6m a year in treatment and loss of production.

The farmers, with assistance from a vet, worked together in the EIP Wales-funded project to use existing scab diagnosis and treatment techniques in a co-ordinated way across farms all within the Ceulanmaesmawr area, near Talybont.

Sheep scab had previously been largely eradicated in Wales but has since re-emerged and is complicated by evidence of resistance to treatments.

In addition, a key issue in tackling scab within and across sheep flocks is the ease of transfer of infection from flock to flock due to the challenges of biosecurity, which is of particular concern in extensive/upland grazing systems and communally grazed areas.

## Did You Know?

The scab mite has the ability to live off-animal in the environment for 16-17 days, making biosecurity, animal handling, and hygiene considerations a high priority.

To address this, farmers should:

- Maintain boundary fencing and checking for gaps/shared rubbing areas

- Double fence where possible with a particular emphasis on high-risk areas
- Communicate with neighbours and co-ordinate treatments
- Select new animals from known sources or health status
- Treat all incoming stock and quarantine for at least seven days
- Clean any shared handling equipment/facilities prior to use.

Dafydd Alun Jones of Ystwyth Vets, who worked with the farmers, said: *“The tendency with scab is that farmers treat or plan to avoid it individually, but it’s the sort of disease where an entire area, or certainly neighbours, need to work together to try and eradicate it.”*

Early and accurate diagnosis allows farmers to quickly isolate any infected animals from the flock to help stop further spreading.

Dafydd, who was responsible for taking blood samples to assist with identification, continued: *“The test we’re using to look for evidence of scab infection is the ELISA blood test. It can detect scab much quicker than an animal shows any clinical signs.”*

*“We can detect scab two weeks after infection with the blood test, where it can take up to a month before an animal starts to scratch. It also makes it easier to detect the disease because it’s sometimes possible to miss scab by using a microscope.”*

If positive for scab, the infected animals were recorded and a treatment plan between the vet and farmer was implemented, with all neighbouring farms notified and tested for scab as soon as it was practical.

Appropriate treatments were discussed between farmer and vet, with priority given to dipping where possible, with an OP (organophosphate) dip providing a better level of certainty and a reduced risk to both human health and the environment when used by qualified contractors.

The project certainly resulted in an increase in the testing and management of scab and also increased the level of communication between the farms and their vet.

While it is not possible to say whether the project reduced scab incidence across the whole area, the project provided the farmers with increased awareness and understanding of flock specific infection routes, diagnosis methods as well as treatment options. It also highlighted the importance of monitoring for infection, even when there were no clinical signs. The ELISA test proved very useful in detecting early outbreaks of scab and before clinical signs were demonstrated.

Learn more about this project.



**Gwaredu Scab**

**Gwaredu Scab can help eliminate sheep scab from your flock**  
**A Welsh Government funded sheep scab eradication programme.**

All scab-infested flocks in Wales can receive **free** veterinary scab diagnosis followed by **free** treatment by approved mobile dipping contractors.

If you have itchy sheep, now is the chance to work with Gwaredu Scab and your sheep farming neighbours to control and eradicate scab from your flocks through this fully funded programme.

**Act now!**

Call 01554 748576 or email: [gwarduscab@colegsirgar.ac.uk](mailto:gwarduscab@colegsirgar.ac.uk)

**01554 748 576 | [ahww.cymru](http://ahww.cymru)**

# Investigation of the effect of contrasting dairy production systems in west Wales on the profile of milk fatty acids (especially omega-3 and 6)

A group of 20 dairy farmers in west Wales came together for an innovative project to collect data relating to the fatty acid profile of this milk field which is produced largely from pasture.



## What is the benefit of boosting omega-3?

Most people are not getting enough omega-3 in their diets, with a tendency to have too much omega-6. Increasing omega-3 intake and getting the right balance of the two is vital and is suggested to have multiple health benefits for mind and body.

The farmers involved in the project reflected four different production systems: conventional housed in winter and grazing in summer, herds housed all year round, organic herds, and herds which undertake block calving in the spring.

During the two-year project, milk and forage samples from all 20 farms were submitted monthly to the Institute of Biological and Environmental Research (IBERS) at Aberystwyth University, together with a questionnaire on feeding practices at the time of sampling.

Seimon Thomas who runs a herd of 900 Dairy Shorthorns with his wife Eleanor and their children, Sion and Hanna, at Drysgolgoch near Llanfyrnach, said: *"If we can substantiate where the omega-3 advantages exist, it will provide opportunities to incorporate this message into the branding and marketing of our milk."*

## Milk Fatty Acids

Results showed that omega-3 varied across the season and between different farming systems. In broad terms, the summer months showed more variation in omega-3 content of the milk, with the organic units' average being highest overall. Conventional and spring calved herd averages were generally higher than housed herds early and later in the grazing season, likely reflecting grass omega-3 content, but showed less difference mid-summer, and during the winter where silage predominated.

Omega-6 levels were higher in housed herds than conventional and spring-calving systems during the grazing period, likely reflecting maize feeding in housed systems. Organic farms were a little higher than conventional and spring calving systems across the grazing season, perhaps reflecting different forage species, or possibly the oil profile in the common organic supplementary feeds.

Ratios of omega-6 to omega-3 fatty acids in milk all lie within what is thought to be the 'healthy' range for a human diet, with the exception of a small number of months for housed systems. The relationship between



Seimon Thomas and daughter Hanna, of Drysgolgoch.

forage levels of the fatty acids showed correlation with milk levels which confirms that forage is a key area to focus on for increasing milk levels.

## Methane production

A further bonus of having elevated levels of these fatty acids in the ration of dairy cows relates to methane production. Various studies have shown that cows consuming significant amounts of spring grass have lower methane emissions per litre due to the fatty acid content of the grass. The fatty acid profile of bulk milk can be easily and cheaply tested and can therefore be used as a basis for calculating the methane output per litre of milk produced.

## Conclusion

Farms in west Wales are particularly well-placed to produce milk higher in omega-3 given that fresh grass is naturally high in these fatty acids. Farms unable to graze still have options to increase the omega-3 content of their milk through techniques such as zero grazing, or the use of feeds naturally high in omega-3 such as extruded linseed. Potential opportunities exist to promote the brand of west Wales dairy farming, particularly linked to the quality and fatty acid profile of fresh grass.

Learn more about this project.





# Lameness in dairy cattle



Farmers discussing solutions for heat stress during a Farmer Led Action Group.

## Exploring different methods of knowledge transfer on behaviour change in dairy producers and subsequent impact on lameness prevalence in their herds.

Lameness is one of the most common diseases in the dairy cattle industry, having huge impacts on animal productivity, welfare, and economics.

This EIP Wales-funded, two-year project aimed to explore different methods of engaging with farmers in lameness management.

Twenty-four dairy farmers from across southeast Wales took part in the project, led by vet Sara Pedersen. Here she answers questions about the project.

### What causes lameness in cows?

*“The top three lesions causing lameness in dairy cows are sole ulcers, white line disease, and digital dermatitis. Each lesion has a wide range of risk factors.”*

*“Two farms may have the same main cause of lameness but the factors behind this may be different, hence there is a need for a bespoke approach on every farm.”*

### What impact does lameness have?

*“Lameness is a sign of pain, so this makes it a significant welfare issue. It also impacts on feed intakes, fertility, milk yield and crucially increases the risk of premature culling.”*

### How is lameness treated?

*“Treatment depends on the cause. Regardless of which lesion is being treated, we should*

*apply the Early Detection and Prompt Effective Treatment (EDPET) approach.*

*“The sooner a cow is treated the better her chances of recovery when best practice treatment protocols are followed. The biggest barrier on farm is usually the early identification of lameness and this then has a significant detrimental impact on recovery.”*

### What were the main objectives of the project?

*“The main aim was to determine how farmers responded to different methods of communication around lameness and which methods were most effective at enacting change.”*

*“Two different methods of sharing knowledge were included in the project – one to one advice through the Healthy Feet Lite Programme and peer group learning through Farmer Led Action Groups. Farmers were able to choose which group they joined based on their preferred method of engagement.”*

### Project Groups (6 farmers in each):

- Group 1: Control (no input)
- Group 2: Healthy Feet Lite
- Group 3: Farmer Led Action Group
- Group 4: Healthy Feet Lite and Farmer Led Action Group

### What were the main findings of this project?

*“Overall farmers in the Intervention Groups (2, 3 and 4) saw a reduction in lameness prevalence of an average of 9% in comparison to 1% for the Control Group.”*

*“Farmers in the Intervention Groups implemented more changes in relation to lameness, saw a larger reduction in losses associated with lameness and were more likely to feel positive towards lameness control by the end of the project.”*

*“When considering how much value farmers placed on the advice received, farmers placed a higher value on the Farmer Led Action Groups in comparison to the Healthy Feet Lite. Reasons for this included the value of learning practical solutions from other farmers, being able to visit other farms to learn from their success and the frequency of meetings meant there was a continued focus on lameness.”*

*“Although there were a wide range of changes implemented across farms, the majority of farmers said that the biggest single positive*

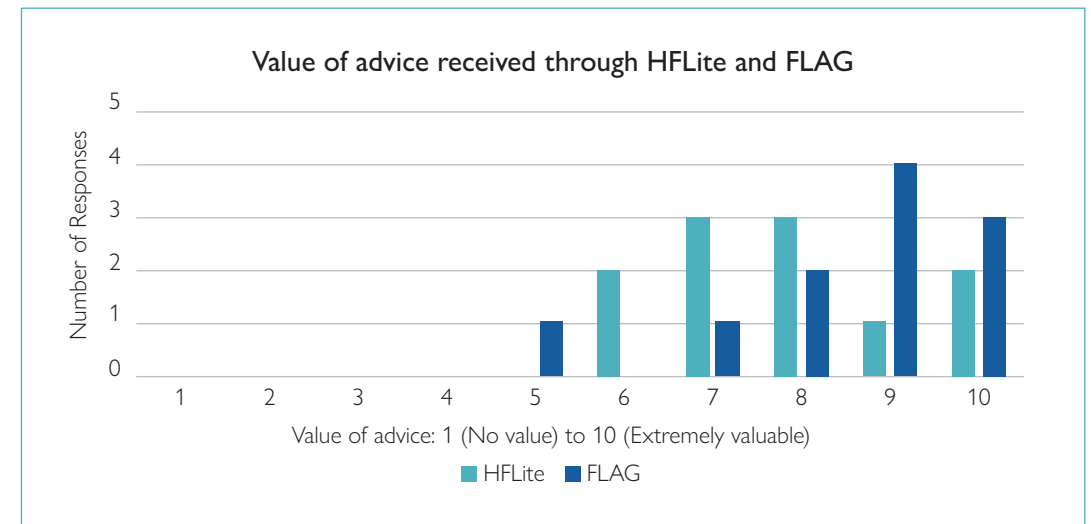
*influence on their ability to improve lameness was changing to a more highly skilled foot trimmer. In terms of negative factors, this was the impact of TB restrictions and in particular the inability to selectively cull lame cows in order to maintain herd size.”*

### What support is offered to farmers to help them deal with lameness?

*“The AHDB Healthy Feet Programme provides a structured programme that farmers can follow alongside a Mobility Mentor to identify the key risk factors for lameness on their farm and develop an action plan to tackle these.”*

*“In Wales, farmers have been able to access funding towards the programme through both Farming Connect and the Herd Advance Scheme. There are also several training courses available to help further develop knowledge and skills.”*

Learn more about this project.





# Net Zero Farming: Assessing opportunities and challenges

The focus of this EIP Wales funded project was to assess the opportunities and challenges for the agricultural sector to reach the net zero carbon target.

Net zero will be achieved on farms when on-farm greenhouse gas (GHG) emissions are matched with on-farm carbon sequestration.

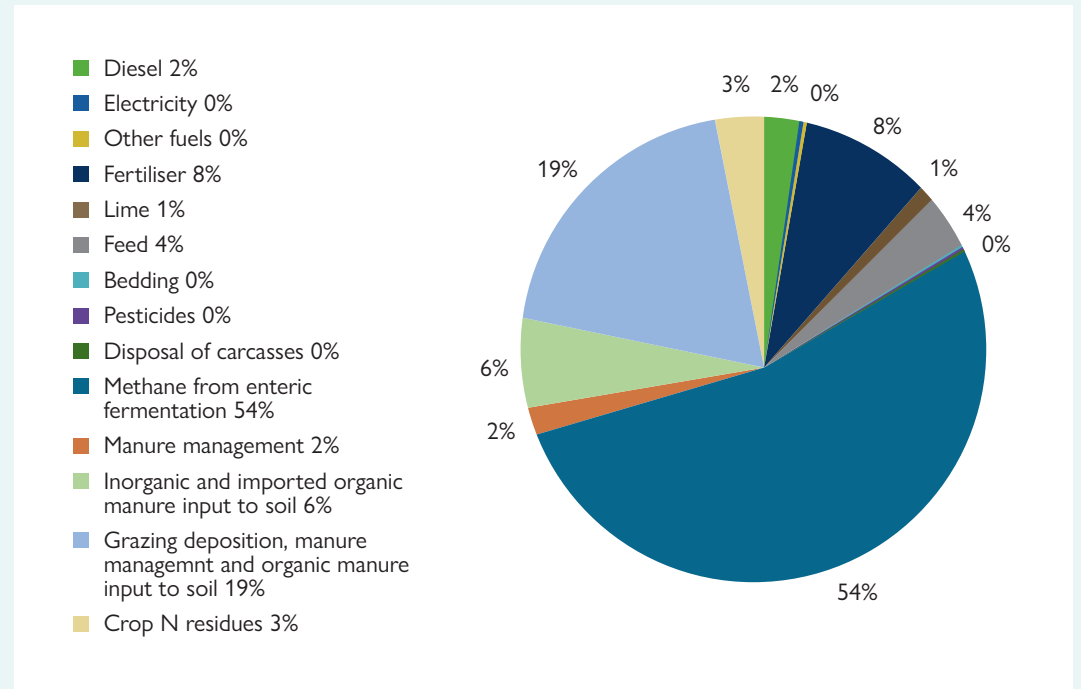
Working closely with Bangor University and Forest Research, six farms from the Brecon area representing a variety of systems, including dairy, beef and lamb aimed to address:

1. Understanding what net zero means for farmers in Wales.
2. Assessing the baseline carbon emissions for participating farms, from which action can be taken and measured.
3. Improving evidence to demonstrate how actions taken on farm can help the industry move towards net zero.
4. Farm outputs: milk, beef, lamb, crop etc.

## Emissions

Bangor University collected data and provided emission estimates (from the inputs used and livestock numbers over the study period). Emission breakdowns were similar across participating farms as most farms have mixed beef and sheep enterprises, except for one farm with a dairy enterprise which had slightly different emission breakdown. As expected, methane from enteric fermentation accounted for the majority of GHG emissions on all farms.

There was seemingly little influence of farm type (e.g., upland or lowland) and farm size or stock numbers on product emissions. However, due to the small sample size of 6 farms, this would need a larger sample size to be validated.

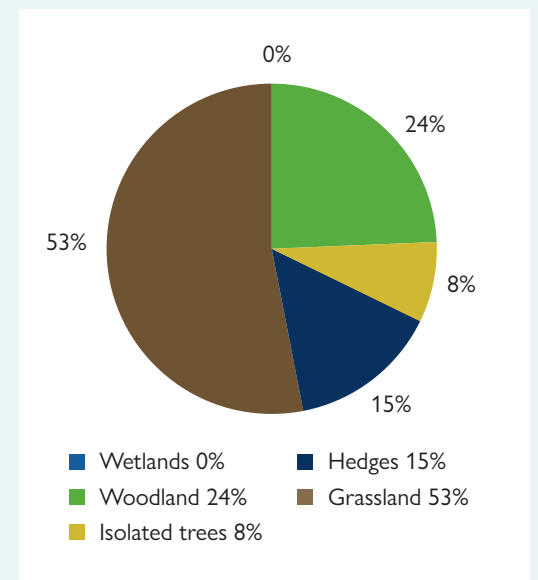


Breakdown of average whole farm GHG emissions sources across the project farms. Note values <0.5% appear as 0% due to rounding.

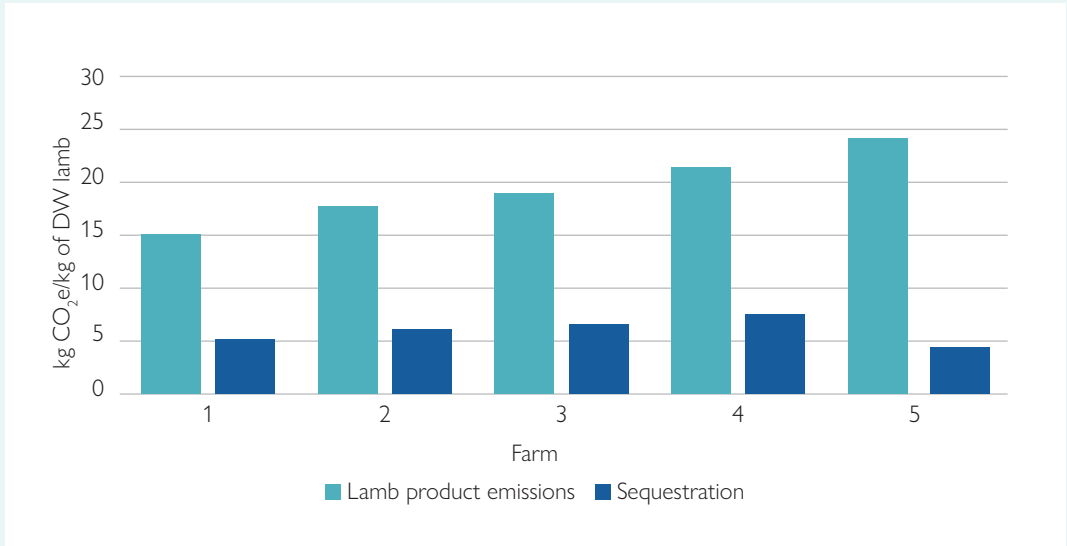
## Sequestration

The Bangor University Carbon Footprinting Tool was used to calculate carbon sequestration rates. Sequestration on study farms was low compared to the level of emissions, offsetting on average 28% of total emissions. Breakdown of carbon sinks was similar across all farms, with the highest sequestration estimates from grassland and soils, at an average 53%, followed by sequestration in woodland at 24%.

The project led to a greater understanding of the current net emissions position across different products and enterprises across the farms. The graph below shows the relative position of the lamb enterprises across each of the participating farms. It demonstrates the scale of the challenge in achieving a net zero position.



Breakdown of average whole farm carbon sequestration sinks across the project farms. Note values <0.5% appear as 0% due to rounding.



Average GHG emissions and sequestration per kg deadweight lamb across the project farms.

This project highlights the importance of carbon footprinting to help identify what has a positive or negative impact on a farm’s carbon balance as well as enabling farmers to monitor changes to their footprint over time.

The majority of GHG emissions from the farms came from livestock (methane) and nitrous oxide from soils, while emissions from inputs (e.g., fuel, feed, and fertiliser) were relatively low. These emissions are hard to reduce, therefore achieving net zero will not be possible through efficiency gains alone.

Sequestration generally made a meaningful contribution to reducing the net emissions position, equating to on average 28% of total GHG emissions. Increasing tree cover on farms will play an important role in increasing sequestration and moving towards net zero.

One of the participating farmers, Hugh Martineau, of Treberfydd Farm, said:

*“We have a unique opportunity in agriculture because we have land, a resource to remove atmospheric carbon dioxide through sequestration into woody biomass and into soils under crops and grass. But we must be realistic on what that potential is, and understand the extent to which we can adopt and maintain sequestration practices in our farm systems.”*

Hugh said an interesting aspect was to reduce emissions, whilst maintaining productivity.

*“It would be easy to reduce emissions by reducing our production but we’ve got to bear in mind that in agricultural systems we want to maintain sustainable production.”*

Learn more about this project.

