

# Genomic and phenotypic advances in hill and maternal breeding programmes

## Unpacking the “Too Difficult” box

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November 2024



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**Lywodraeth Cymru**  
Funded by  
**Welsh Government**





# The ewe flock is at the heart of successful sheep farming

Two projects that are advancing the use of genotypes and phenotypes in hill and maternal breeds:

- Welsh Sheep Genetics Programme
- Breed for CH4nge





## Welsh Sheep Genetics Programme

- Follow on from HCC Hill Ram Scheme
- Tier 1 – Hill flocks
  - 33 flocks from HCC HRS
  - 18 new flocks joined Autumn 2024
- Tier 2 – Maternal flocks
  - 7 Blue-faced Leicester flocks
  - 8 Lleyn flocks
  - 5 Romney flocks
  - 4 Charmoise Hill flocks
- Further round of recruitment just closed



## DNA parentage helps with recording hill sheep

- Hill flocks
  - 32 Using DNA for parentage
  - 19 single sire mating and recording at birth
- 73 000 genotypes collected since 2019
- Adding value : Single step genomic evaluation for all hill sheep introduced in 2023
- In addition several Cheviot and Blackface flocks now genotyping and recording





# Using genotypes to make more of phenotypes

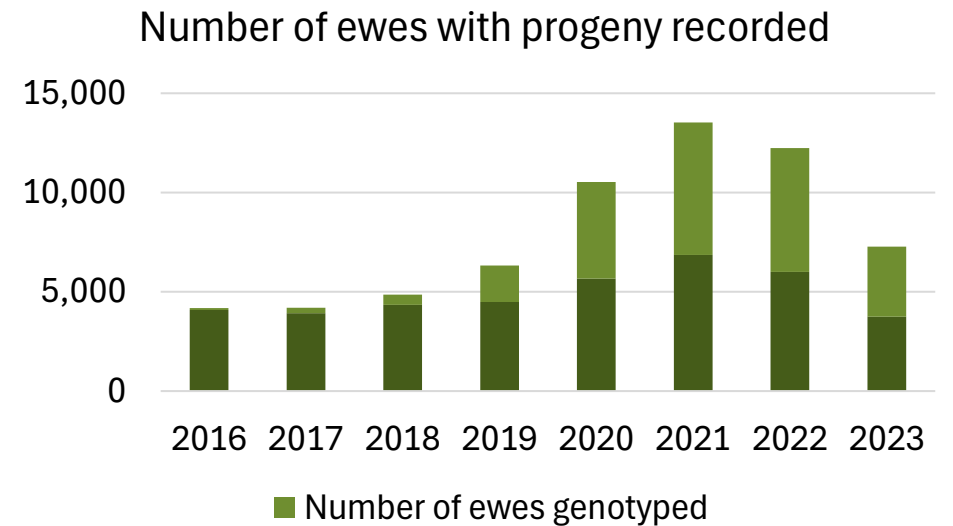
Maternal traits and lamb survival are key to the improvement of hill sheep

- low heritability
- sex limited
- recorded over the ewe's lifetime



Genomic BVs → increased accuracy

Genomic profiling now offered to all flocks in WSGP



## Collecting 'new' phenotypes

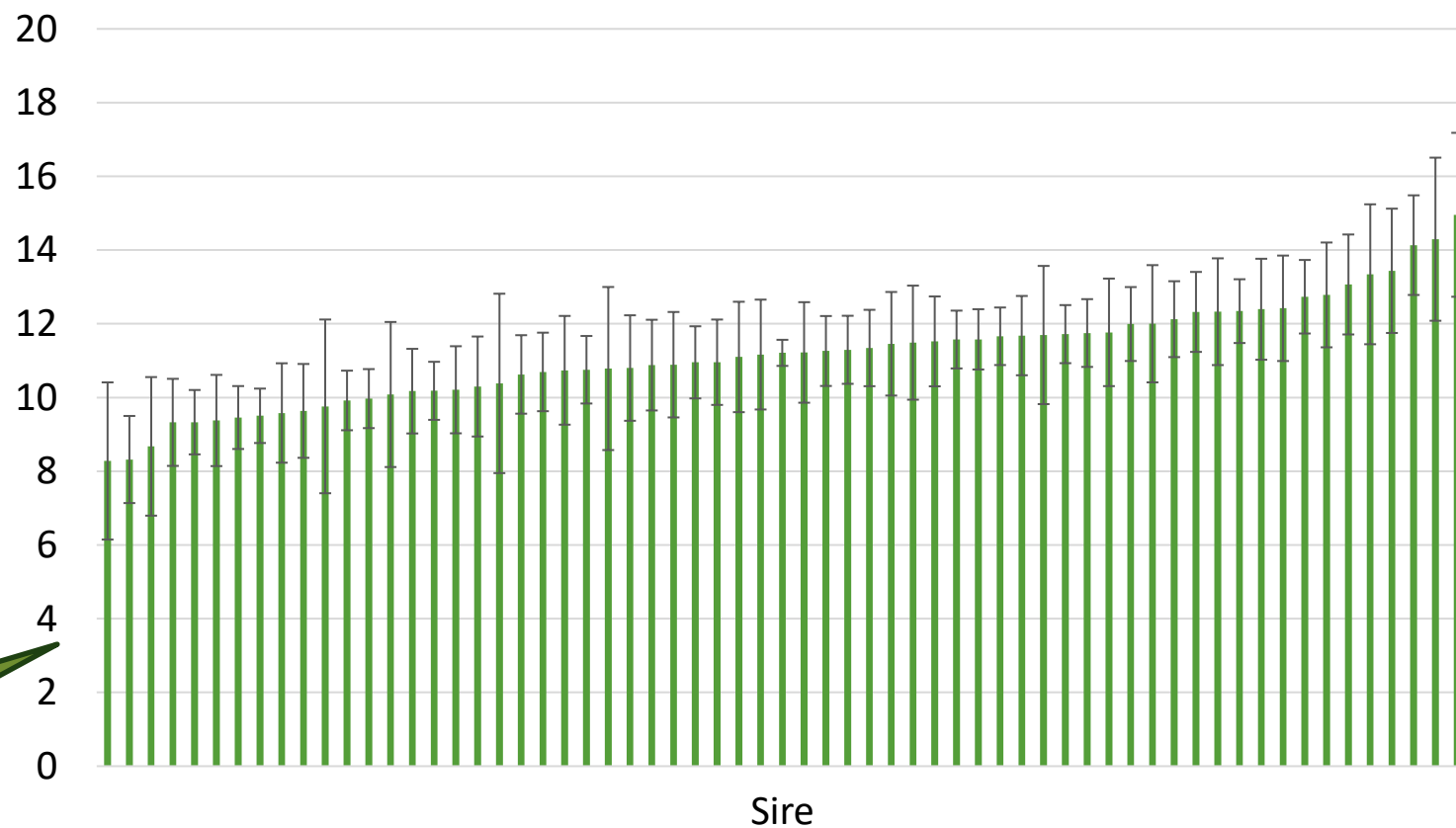
- Parasite resistance (FEC and IgA)
  - 999 samples from 17 flocks in 2023
  - ~ 950 samples so far in 2024
- Methane output and CT rumen volume
  - Methane (PAC) 649 animals in 2024
  - CT rumen volume – 504 animals
  - Progeny of 83 sires – 50 both PAC and CT
  - All genotyped – maximise value from phenotype





## New phenotypes – a learning curve

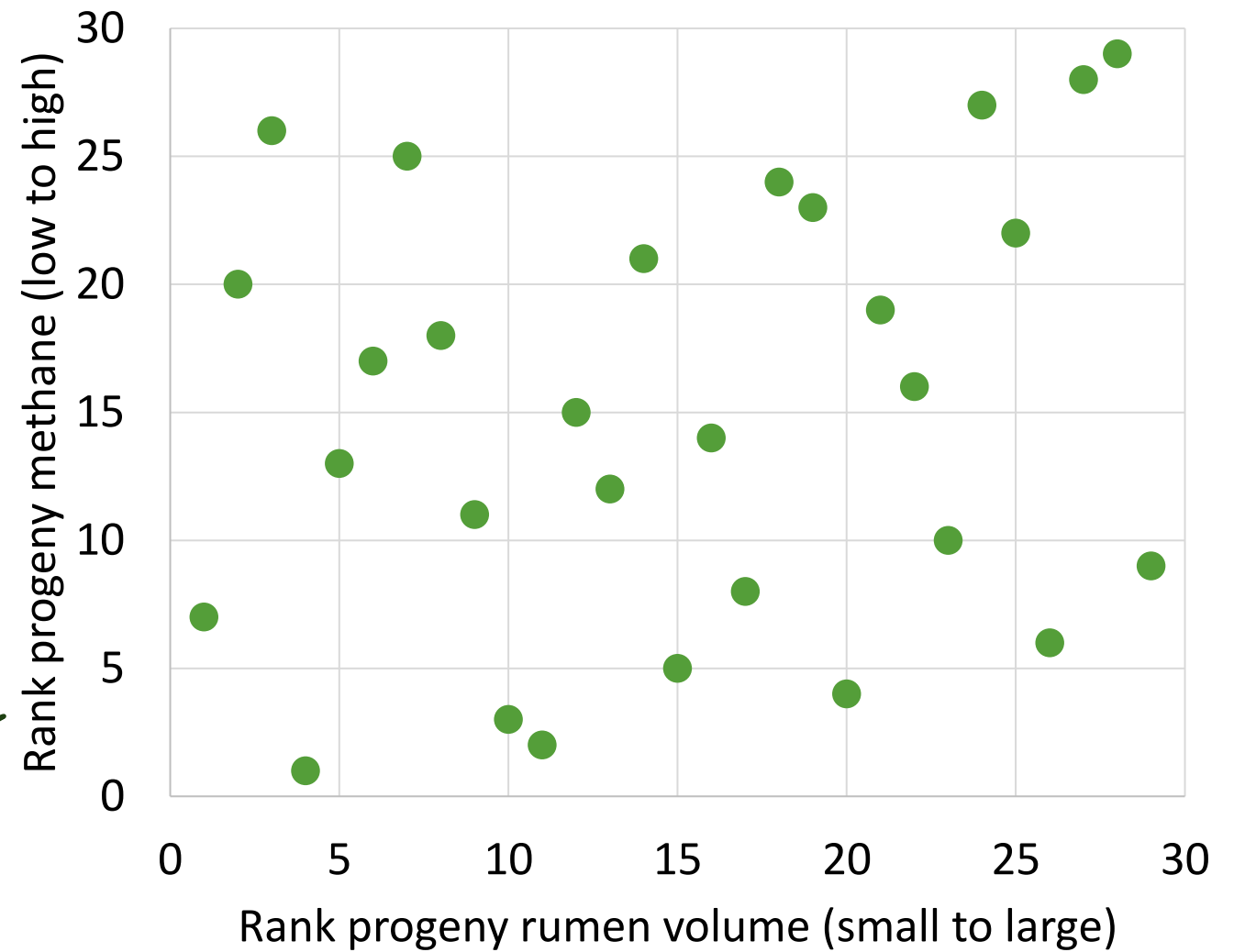
Mean methane (g/day, adj. for liveweight) of progeny



Significant variation between  
sires



## New phenotypes – a learning curve



There *may* be a positive genetic correlation – BUT still plenty of scope for selection



## Welsh Sheep Genetics Programme

- Assisting breeders to collect more and better phenotypes
- Added value from genotypes
  - Parentage assignment
  - Single step genomic breeding values
    - Increasing accuracy of maternal trait BVs
  - Maximising value from expensive phenotypes







**BREED FOR CHANGE**

BREEDING LOW METHANE SHEEP

## Breeding Low methane sheep: Breed for CH4nge

- DEFRA's Farming Innovation Programme
- Aim: To find the best breeding strategy to sustainably reduce methane/kg output from ewe flocks
- Focusing on maternal breeds with long history of well recorded maternal phenotypes
  - Innovis maternal lines + Cheviot
  - PRLB – Lleyn
  - SIG – Exlana
  - Centurion - Dorset







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BREEDING LOW METHANE SHEEP

# Phenotypes for lower methane/ kg output

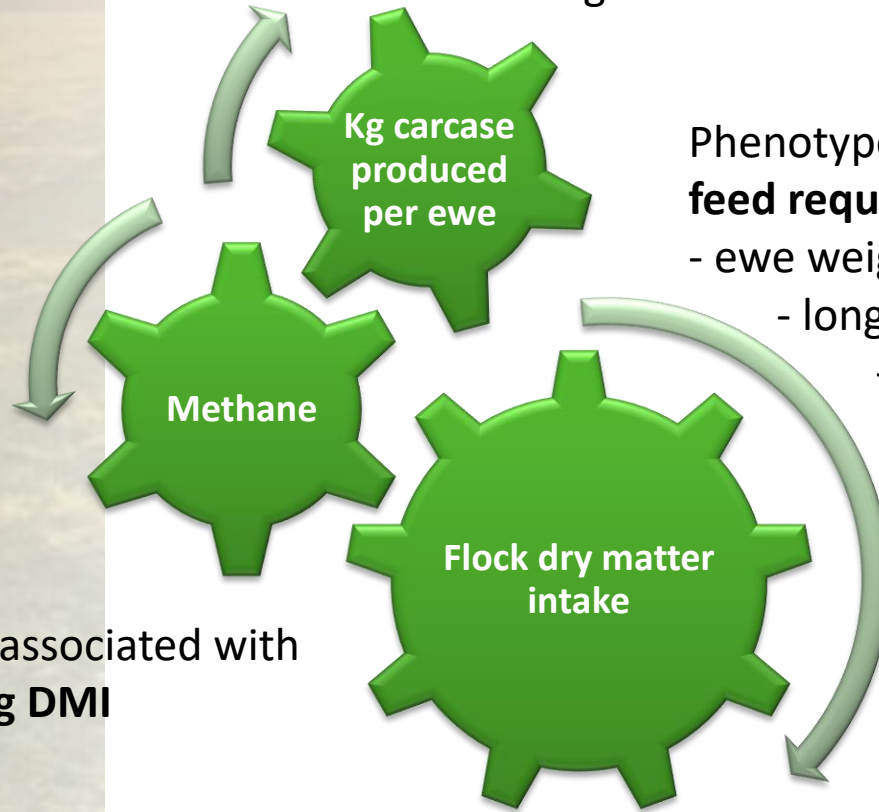
Phenotypes associated with **output**

- lambs reared
- maternal ability
- lamb growth etc



Phenotypes associated with **feed required**

- ewe weights and BCS
- longevity
- health (days on farm)
- feed efficiency



Phenotypes associated with **Methane/ kg DMI**



**BREED FOR CHANGE**

BREEDING LOW METHANE SHEEP

## Collecting phenotypes associated with methane

- Portable Accumulation Chamber CH<sub>4</sub> and CO<sub>2</sub> measurements
- 2023/4 3300 lambs measured (x 2) in 27 flocks
  - See Karolina Kaseja poster for preliminary results
- 2024/5
  - 4623 spring born lambs – Autumn 2024
  - 500 Dorset lambs + 400 Innovis lambs Spring 2025

All genotyped (to maximise value of expensive phenotype)





**BREED FOR CHANGE**  
BREEDING LOW METHANE SHEEP

# Collecting 'difficult' phenotypes to help identify the best breeding strategy



Lifetime methane output – annual measurement



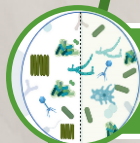
Monitoring of body condition - lifetime



Feed intake and efficiency



Measuring rumen volume (CT)



Monitoring the rumen microbiome



Grazing intake/behaviour







**BREED FOR CH4NGE**  
BREEDING LOW METHANE SHEEP

## Breed for CH4nge

- Collecting new phenotypes and learning how to use them
- Collecting genotypes to add value to “hard to measure” and expensive phenotypes
- Developing **selection index** to rank animals on their potential to reduce methane/kg output – **available through Signet evaluations**
- Will share findings on how best to use the new phenotypes





A flock of sheep is gathered in a green field, with a fence visible in the background. The sky is filled with dark, dramatic clouds, suggesting an approaching storm or late afternoon light. The foreground shows a path leading towards the sheep, and the right side of the image features tall, golden grasses.

Questions?