Breeding For Worm Resistance
What are we?

- Performance led sheep breeding company
- Allowing sheep to express their genetic potential
- EID based recording for 11 years (many more on paper)
- 28k EID breeding records and growing
- 3.2k individual FEC records
- Genetics not cosmetics
- Emphasis on ‘ignored’ traits - - FEC/footrot/mastitis
Internal parasites---what’s the problem?

• 3rd largest economic driver in commercial lamb production
• Largest economic health problem in worldwide sheep production systems
• Running out of chemical options----resistance is ALWAYS increasing
Resistance vs. Resilience

We describe resistance as ---

The ability of the sheep to resist the challenge of the worms – To inhibit their development and reduce the number of eggs laid

Resilience is -----

The ability of the sheep to continue to be productive whilst hosting a large worm burden which continues to lay eggs
Genetic approach to internal parasite control

- It’s a measurable trait
- It has significant variation
- It has good heritability 0.19 (S) 0.13 (N) [scan wt 0.18]
- It is economically important
- Measure under pressure
- So we can select
- So we can breed for this trait
- So it is worth doing
Method

• Measure and record
• Analyse
• Select
• CULL
• And repeat every year ---

• Finger technology & FEC
• BLUP
• Data is king
2014 Trials ----Theory

- From ongoing work we see that FEC EBVs are accurate and have decent heritability in lambs

- But does this translate to egg output in lactating adult ewes?

- If so = reduced worm burden for new lambs
2014 trials----Practice

• Identify group of 80 ewes with variety of good and bad FEC EBVs

• Reduce variation within group---all rear twins, similar age ewes, all treated identically

• Measure individual FEC 10 days before lambing and every 2 weeks thereafter

• Duplicate trial on another farm
38% difference in egg output between top and bottom quartile FEC EBV ewes
50% difference in egg output between top and bottom quartile FEC EBV ewes
So???

• Juvenile FEC correlates with adult FEC

• Reduced adult FEC especially during periparturient rise is very important in reducing worm challenge to young lambs

• This is very important for a maternal ewe and her lambs performance
Exlana SNP association study results with The Roslin Institute

- 200 DNA samples from ewe lambs with recorded FEC and weight at 20 weeks old
- 15 SNPs (mutations) in 3 genes were sequenced in the lambs
- The 3 genes had previously been found to be involved in the development of worm resistance
- A significant association was found between FEC and a SNP in the Exlana lambs
- Lambs with the A allele on both chromosomes tended to have higher FEC than lambs with the G allele

### Model prediction of FEC based on SNP7 in Exlana’s

<table>
<thead>
<tr>
<th>Gene</th>
<th>Allele</th>
<th>No. lambs</th>
<th>Average FEC (epg ± error)</th>
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</thead>
<tbody>
<tr>
<td><em>IL23R</em></td>
<td>AA</td>
<td>179</td>
<td>832 (±993)</td>
</tr>
<tr>
<td></td>
<td>AG</td>
<td>17</td>
<td>700 (±964)</td>
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<tr>
<td></td>
<td>GG</td>
<td>0</td>
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Translating this into practicalities

• On farm uses of superior genetics is not instant
• Improvements in commercial flocks are hard to measure, too many variables & farmers are poor data collectors

• Anthelmintics are!
• You can’t just use a ram with good FEC EBVs and expect to instantly reduce your worming schedule
So, how do lamb producers breed for worm resistance?

• If you are breeding your own replacements
  
  • If you buy in replacements
  
  • Buy a tup with a good FEC EBV from your ram breeder (it’s his/her job to provide these animals for you)
  
  • Buy ewes from a breeder who has a good breeding program and breeds for worm resistance
So this is where we are now----

EXLANA ewe lambs--16 months old and all raised a lamb, never wormed

The future -----???
Where next?

Further measurement & selection for genetic resistance

Should we be selecting for resilience as well as resistance?

Can we select for animals that exhibit resistance earlier in life?