Moredun Research Institute
To prevent and control infectious diseases of livestock
Sheep scab testing on the Isles of Mull & Iona
Sheep scab (Psoroptes ovis)

- One of the top 5 sheep diseases in Scotland (financial and welfare perspectives)
- Endemic in UK, ~ 8,000 outbreaks in 2003/2004 – costs ~£9 million/year for control alone
- Approximately 10 – 15% of Scottish sheep farms experience sheep scab in any one year
- Notifiable in Scotland since 2010 (Sheep Scab Order (Scotland))
Sheep scab (Psoroptic mange)

- Once infested it can take several weeks before clinical signs appear

- Scab is highly infectious and can spread rapidly during this sub-clinical period with 60-90% of a flock becoming infested before signs are identified
Risk and sheep scab

• Time of year: Majority of outbreaks still between September and March

• Elevation, temperature and rainfall accurate predictors of outbreak risk

• Evidence of foci or “hotspots”:
  • <12km spread within 5 months of outbreak
  • 85% of farms reporting an outbreak in 2007/2008 had at least one each year in the previous 10 years
  • 76% of farms reporting no scab outbreak in 2007/2008 had not had an outbreak of scab in the previous 10 years
Sheep scab; Foci and Risk

Repeated Outbreaks ✔ Common grazing

Repeated Outbreaks ✔ Common grazing

88% of farmers believe common grazing is source of outbreak

38% of farmers believe outbreak originated from neighbours

38% from bought in animals

Common grazing increases likelihood of contracting sheep scab by 9.6 fold

Diagnosis – accurate diagnosis essential

The correct treatment needs to be administered.

Differential diagnosis from:

* Blowfly strike*
* Lice*
* Forage mite dermatitis*
* Fly bite allergy*
* Ringworm*
* Mycotic Dermatitis*
* Wool slip*
* Physiological / Traumatic wounds*

Inappropriate treatment may not work against scab

Added costs of re-mustering, retreatment and associated meat withdrawal periods etc.

Legislation may impose movement and treatment restrictions following diagnosis.
Diagnosis 1. – Confirmatory Diagnosis – during an outbreak

• Failure to accurately diagnose clinical cases
• Sensitivity may be low – in asymptomatic “carrier” animals as low as 18%
• Failure to detect sub-clinical disease in new infestations
Diagnosis 2. – Screening flocks or incoming animals, where there are no current signs of disease.

Recent infestation

Susceptible sheep
Can take weeks to months to show signs of disease

“Immune” sheep
Has mites but no signs of disease

Current, low level infestation
Rapidity of antibody response to *P. ovis* following infestation
Specificity testing

No known cross-reactivity with other common infections:

- Lice infestation
- Ticks
- Gastrointestinal worms
- Orf infection
- Lumpy wool, mycotic dermatitis (*Dermatophilus congolensis*)
Sensitivity (98.2%) and specificity (96.5%) of optimised sheep scab ELISA, using field samples

Figure 6. ROC curve (sensitivity vs specificity) for 433 P. ovis negative samples vs 55 P. ovis clinically positive samples using the optimised ELISA protocol, AUC = 0.997.

Optimised trade off: 1.8% FN = 3.5% FP
Preliminary, market-survey data from a questionnaire to Sheep Veterinary Society members on the use of the test

<table>
<thead>
<tr>
<th>Potential applications</th>
<th>Clarify cases where scrapes are negative but a strong suspicion of scab</th>
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<tbody>
<tr>
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<td>Distinguish between lice and scab</td>
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<td>Testing farms adjacent to an outbreak to monitor spread of an outbreak</td>
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<td>Organic farms to avoid unnecessary treatment with long withdrawal periods</td>
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<td>Sheep sales/ markets to test bought in sheep</td>
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<td>Test animals coming into clear areas/quarantine</td>
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How does the test work in a natural outbreak

- Outbreak of scab reported on Moredun Farm (August 2009) – having spread from an infested ewe from another farm

- All animals (159) examined for clinical/behavioural signs of disease

<table>
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<tr>
<th>Number of Animals</th>
<th>Disease Signs</th>
<th>No symptoms</th>
<th>Positive by ELISA</th>
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<tr>
<td>27/159</td>
<td>132/159</td>
<td>105</td>
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- Highlights the difficulties of diagnosing early disease through the presence of clinical signs alone

- Demonstrates ability of the test to detect sub-clinical infestations
Sheep scab free Mull?
Notifications under the Sheep Scab (Scotland) Order 2010 until December 2015

- Was Mull scab-free?
  - If so then how do we keep it that way
  - If not, to eradicate it, we needed to know where it was

- What are the benefits of knowing true status?

- How do we keep it like this?

N. D. Sargison, and V. Busin. Veterinary Record 2014;175:481-483
NFUS, Moredun & Mull Vets campaign

Model:

**Year 1. Test all flocks on the Island during summer/autumn 2013.**

• Isolated 12 animals from each management group, blood tested and **retained for 10 days**

• Results reported within 10 days:
  • If negative – no further action required
  • If positive – re-tested and skin scrape taken(Mull Vets)

No cost to individual farmers as all costs for testing covered by Moredun/NFUS
NFUS, Moredun & Mull Vets campaign

- Total number of samples tested (excl. re-tests) = 715
- Number of samples above the cut-off = 23 (~3%)
- Number of samples above the cut-off on re-test = 9 (~1%)
- Number of animals exhibiting clinical signs following re-test = 0
- Conclusion for year 1 – Mull & Iona appeared to be scab free
Year 2. Maintain status by screening and quarantining incoming stock, test tup going out and after tupping, also any overwintering hoggs on return to island as well as any animals returning from shows etc.

- >500 animals tested in total
- Different pattern of responses to Year 1 (more borderline and positive tests)
- Follow up revealed an outbreak of sheep scab in defined area
- Scab identified but unable to be confirmed (or notified) as animals treated
- All positive animals, contiguous flocks and movements followed up
- No further outbreaks/cases detected but highlights need to be vigilant
Sheep scab free Mull?
What next for Mull

- Assume that Mull is either free of scab, or that disease is present but at a very low level – ‘Island’ status means risk of further outbreaks is low

- Without blanket treatment of all animals, complete eradication not possible

- Biosecurity and quarantine most potent tools to maintain status
Biosecurity & Quarantine

- **Maintain fencing** and check for gaps/shared rubbing areas
- Double fencing ideal but at least cover 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 7 days**
- Clean any shared handling equipment/facilities prior to use
Limited treatment options:

**OP dips:**
- Risk to human health and environment
- High labour costs
- Disposal of spent dip is carefully controlled (SEPA)
- Long withdrawal periods (70 days)
- Cannot dip young lambs/pregnant ewes

**MLs (injectables):**
- Misdiagnosis and inappropriate use, i.e. lice and lack of efficacy
- Long withdrawal periods (37-104 days)
- Anthelmintic resistance in worms and emerging resistance in mites?

Visit SCOPS website for up to date advice on treatment: http://www.scops.org.uk/ectoparasites-sheep-scab
Costs of sheep scab

- Ewe, ram, lamb mortality
- Loss of body condition
- Hypothermia
- Secondary infections
- Reduced tupping rate
- Low birth weights
- Reduced milk yield and lamb growth rates

- **Cost of treatment – medicines, labour, contractor hire, disposal etc**
- Veterinary costs
- Lost marketing opportunities through meat withdrawal periods
- Repair of fences and buildings through excessive rubbing
- Lost time regarding other farm enterprises
- Legal costs
The Stubbings model 2007

- Based on an outbreak of scab in a hypothetical flock of 1700 mule ewes

- Financial losses within the flock:
  - 25% increase in lamb mortality.
  - Increased lamb finishing time of 2 weeks
  - Additional lamb (creep) feed for 2 weeks
  - Cost of treatment (single injection of doramectin)
  - Reduced fleece value by 50%

- Overall a potential profit of £5.27 per ewe was reduced by £18.84 to an overall loss of £13.57 per ewe.
ADAS model 2013

• Cost of an outbreak of scab within a hypothetical flock of 500 ewes:
  • Rearing percentage of flock reduced by 15% - £5,250
  • Whole flock treatment (£1.40/ewe) - £700
  • Labour for treatment (2 days) - £200

Total cost of dealing with outbreak = £6,150 or £12.30/ewe

• Cost of treating to prevent scab in the same flock:
  • Whole flock treatment (£1.40/ewe) - £700
  • Labour for treatment (2 days) - £200

Total cost of prevention = £900 or £1.80/ewe

However, don’t rely on routine seasonal or annual treatment with MLs to control sheep scab (may contribute to wormer resistance) as good biosecurity and effective quarantine is sufficient.

• From a cost-benefit perspective it is better to treat to prevent sheep scab, than to deal with the costs of an outbreak.
Cost of diagnosis to control sheep scab

Two approaches tested on Mull:
- Whole flock testing (x12/management group)
- Tup (sentinel) testing

When could you use the test:

Instead of routine prophylactic treatment (Autumn)?

- If negative – potential saving of >£800
- If positive – additional cost of £60 or less
Pen-side testing for sheep scab

- Many advantages to pen-side testing:
  - **Cheaper** - potentially very low cost (<£1)
  - **Quicker** - pen-side testing gives quick results (<30 mins)
  - **Rapid diagnosis** - enables rapid treatment decision
  - **Smart** - can be linked to a smartphone camera via an app to vet
  - **New device tested this month** <5 mins and <£1

- How to best use a pen-side test:
  - Markets/shows
  - Introducing new stock
  - Confirmation in suspected cases (skin scrape -ve but positive signs)
Thank you
How many sheep to test?

For a test outcome accuracy of at least 95%

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<th>Flock size</th>
<th>Disease Prevalence in flock (%)</th>
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<td>1</td>
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<td>20</td>
<td>19</td>
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<td>39</td>
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<td>100</td>
<td>55</td>
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<tr>
<td>200</td>
<td>63</td>
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Giles Innocent, BioSS, unpublished