Improving the Control of Liver Fluke in Cattle (ICLiFC)

BBSRC
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Background

- Digenean trematode parasite
- Found in temperate and high altitude tropical regions throughout the world
- Highly pathogenic, affecting health, welfare and the productivity of food and fibre producing animals
- Important human pathogen
The life cycle of *Fasciola hepatica*

- **Eggs shed in the dung onto pasture.**
- **Eggs develop.**
- **Eggs hatch and swim through plane of water to find a snail.**
- **Intermediate host are mud snails.**
- **Fluke multiplies in the snail.**
- **Flukes leave the snail and encyst on grass.**
- **Cysts on pasture are eaten by cows as they graze.**
- **Adult fluke in liver of cattle.**
Fluke – a changing picture

• Increasing prevalence and distribution of *Fasciola* infection in UK

• Rapid emergence of resistance to flukicide, triclabendazole, fasinex

• Effects of recent and projected climate change

• Increased susceptibility to other diseases

Diagnoses of fasciolosis in cattle as a % of total no. of submissions for which a diagnosis was reached.
Improving control of fluke

• How can we improve fluke control whilst relying less on drug treatments
  – Few drugs licensed for use in dairy cattle
  – Triclabendazole resistant fluke are widespread in sheep and recorded in beef cattle

• Need to understand factors leading to high fluke infection
What factors drive the distribution of fluke?

- Rainfall
  - Single biggest explanatory variable
    - Summer rainfall
    - Previous five years
- Temperature
  - Warm winters
  - Cool summers (= rainy)
- Physical factors
  - Altitude, slope,
  - Soil type,
  - Minerals

Models explain about 78% of variation between post-code areas.
What about at the farm level?

- Climate drives spatial distribution of fluke at the regional level

- But within a post code area there are big differences between farms

![Map showing fluke distribution with color codes: 5 – 27 (negative), 27 – 50 (low positive), 50 – 100 (medium positive), 100 – 190 (high positive).]
Farm specific factors

- Presence of snail habitat and snails
- Interaction between cattle and snail habitat
- Management and grazing plan
- Presence of different types of stock and wildlife on a farm
- Others?
ICLiFC Project

Aim: to improve control of *Fasciola hepatica* infection in cattle by developing new management tools that can be applied cost effectively, reducing reliance on drugs

- University of Liverpool
- Moredun Research Institute
- Centre for Ecology and Hydrology
- SRUC, Scotland’s Rural College
- AHDB Beef and Lamb
- AHDB Dairy
- Quality Meat Scotland
- Hybu Cig Cymru
- The Northern Ireland Agricultural Research and Development Council
WP1: Development of herd level diagnostic tests to quantify levels of infection in beef and dairy herds. Development of tests to discriminate between *Fasciola* and paramphistome infections. Months 0-12.

WP2: Development of methods to characterise snail habitats for use in remote sensing databases. Description of interactions between cattle and intermediate snail host. Months 0-12.

WP3: Risk factor analysis to identify possible risk factors for fluke infection on dairy and beef herds. Months 6-18. Logistic regression models to prioritise management practices that could be altered to reduce the level of infection and that are economically beneficial. Months 12-24. Mathematical models to test theoretical impact on worm burden and pasture contamination of interventions. Month 18-30.


WP5: A pilot intervention study to evaluate the cost and the effectiveness (reduced infection) of implementing management changes defined in WP5. Months 30-42.

Progress so far:
WP1 – lead MRI

- Diagnosing infection, identifying infected herds
- Diagnostic tests
  - Faecal egg counts (FEC)
  - Antibody ELISA
  - Copro-ag ELISA
- 40 cattle sampled on each of 5 beef farms on three occasions
- Copro-ag ELISA & FEC compared, for individual samples and composites (n=10)
- Molecular methods investigated – copro PCR plus LAMP
Copro-ag is ELISA less sensitive than FEC
Testing for eggs in dung of 10 individual animals can detect infected herd BUT depends on time of year and prevalence in that herd.
Composite FEC is as good and more cost effective
Progress so far
WP2 – lead CEH

• Identify and classify areas of pasture where snails are found
• Identify those areas where metacercariae (cysts) are found
• Characterise cattle grazing habits to understand the interaction between snails and cattle
Progress to date – WP2
Lead: CEH

Categorised pasture type and recorded extent and duration of grazing behaviour on four beef farms at the field level.

Caught and identified snails each month
WP2 Results

- Density of snails was very, very low in 2014
- No known *Galba* spp. were found on improved pasture.
- Rushy ground and wet flush/water courses were the only locations where snails were present.
- Cattle spent most time grazing in improved pasture and sparse rush areas
- Faeces dropped in wet flush areas
Progress so far

WP3 – lead Liverpool

• Identification of on-farm risk factors for *F. hepatica* infection in dairy and beef enterprises

• Development of statistical and mathematical models to predict the likely benefits of implementing changes to farm practice on fluke prevalence
WP3 Results

- 195 farms were visited Oct 2014 – Apr 2015
- 198 sets of samples
- 104 dairy
- 94 non-dairy (76 suckler herds, 12 stores/finishers, 6 dairy replacements)
- 192 Questionnaires completed

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Mean</th>
<th>Number of farms</th>
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<tbody>
<tr>
<td>Grassland</td>
<td>235 acres</td>
<td>189</td>
</tr>
<tr>
<td>Dairy cows</td>
<td>178</td>
<td>100</td>
</tr>
<tr>
<td>Beef cows</td>
<td>53</td>
<td>78</td>
</tr>
<tr>
<td>Total cattle</td>
<td>246</td>
<td>192</td>
</tr>
<tr>
<td>Sheep present</td>
<td>84/192</td>
<td>43.75</td>
</tr>
<tr>
<td>Over-winter sheep</td>
<td>75/192</td>
<td>39.06</td>
</tr>
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</table>

Map of England and Wales showing study farms (n=195) located in the County of Shropshire
Map of Shropshire showing results of Faecal analysis for liver fluke eggs at sampled farms

- Result not available yet
- Negative
- Positive

<table>
<thead>
<tr>
<th>BTM ELISA (pp-value)</th>
<th>BTM Result Category</th>
<th>Frequency</th>
<th>Percent</th>
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<tbody>
<tr>
<td>&lt;27</td>
<td>Negative</td>
<td>51</td>
<td>59</td>
</tr>
<tr>
<td>27 - 49</td>
<td>Low positive</td>
<td>22</td>
<td>26</td>
</tr>
<tr>
<td>50 - 99</td>
<td>Medium positive</td>
<td>11</td>
<td>13</td>
</tr>
<tr>
<td>≥ 100</td>
<td>High positive</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>86</td>
<td>100</td>
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</table>

<table>
<thead>
<tr>
<th>Faecal result</th>
<th>Dairy</th>
<th>Non-dairy</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative</td>
<td>52 (60.47%)</td>
<td>45 (54.22%)</td>
<td>97 (57.40%)</td>
</tr>
<tr>
<td>Positive</td>
<td>34 (39.53%)</td>
<td>38 (45.78%)</td>
<td>72 (42.60%)</td>
</tr>
<tr>
<td>Total</td>
<td>86</td>
<td>83</td>
<td>169</td>
</tr>
</tbody>
</table>

Next steps:
- Data quality check - second data entry of questionnaire results
- Map data
- Climate data
- Environmental data
- Farm photographs

Identify risk factors/protective farming practices

Statistical & mathematical models

Interventions
Progress so far
WP4 – lead SRUC

• True costs of fluke are not clear either at the farm or national level
• To effect change, and reduce reliance on drugs, must demonstrate that management/control changes cost less than the benefits accrued
• Herd level economic models for
  – Suckler cow
  – Growing animal
  – Dairy cow
WP4 Results

• Losses due to reduced growth rates, infection in dam, reduced milk yields

• Suckler herd:
  – £193 for a spring/summer born calf
  – £45 for an autumn born calf

• Dairy herds:
  – £162-£224 per cow per year due to reduced milk yield (cf high yielding herds of £324 per cow per year).

• Growing animal:
  – £17 per beef steer
  – £50 for replacement heifer
Can we improve control of fluke on your farm?

- No snails = no fluke
  - No molluscicides licensed in UK
  - Drainage affects wildlife as well as snails
  - Environmental stewardship schemes
- Reduce egg output/eggs reaching water
  - Treating stock in spring to reduce egg shedding
  - But beware clonal expansion in snail
- Reduce contact between cysts and cattle
  - Avoid at risk pasture during late summer/early autumn
Can we improve control of fluke on your farm?

• Identify the risky pastures on your farm
• Where possible reduce snail habitats e.g. ensure drinking troughs don’t leak
• Monitor infection in your herd (blood test, FEC, abattoir returns)
• Develop an annual fluke plan – avoid flukey pasture in the autumn
• Select treatments according to stage of fluke in the animal
• Consider ALL the stock on your farm (sheep, beef, young stock)
• Quarantine bought in stock – test and treat
Thank you