Parasite Control on Organic Sheep Farms in Ontario

Dr. Laura C. Falzon
PhD candidate, Department of Population Medicine, University of Guelph
(some slides courtesy of Dr. Andrew Peregrine and Dr. Paula Menzies, University of Guelph)
Gastro-Intestinal Nematodes

- Parasites inhabiting the alimentary tract of small ruminants

- Responsible for severe economic losses caused by:
  - Decreased production
  - Death of infected animals
  - Cost of prevention
  - Cost of treatment

(Barger, 1982; Donald and Waller, 1982)
Gastro-intestinal Nematodes

- **Haemonchus**
- **Teladorsagia**
- **Trichostrongylus**
Haemonchus contortus

- *H. contortus* is the most pathogenic – the adult female worm feeds on blood

- Causes:
  - Loss of blood – **Anaemia**
  - Loss of protein – **Oedema**
Clinical Signs of *Haemonchus* infection

Pale mucous membranes - **Anaemia**

Bottle-jaw - **Oedema**

(Courtesy, Dr. Paula Menzies, University of Guelph)
**Teladorsagia circumcincta**

- Adult localized in *gastric glands*
- Disruption of abomasal mucosa results in increased pH and reduced pepsin production

**Trichostrongylus axei**

- Adult embedded in *abomasal mucosa*
- Disruption of abomasal permeability alters pH and nutrient absorption
Clinical Signs of *Trichostrongylus* and *Teladorsagia* infection

- **Diarrhea** - scouring
- **Poor weight gain**
GIN Life Cycle

1. Adult worm produces eggs

2. Eggs in faeces *

3. Eggs hatch to L1

4. Develop into L2 and infective L3

5. L3 moves onto herbage *

6. L3 ingested and moves to abomasum

7. L4 develops in mucosa
Epidemiology of GIN

• A three-year epidemiological study was conducted in Ontario and Quebec (2006-2009)

• The objectives were:

  – To determine the levels of GIN in both organic and conventional flocks throughout the year

  – To identify farm management practices that can be used to minimise parasite burdens
Epidemiology of GIN

- A total of 31 farms were visited over the 3 years (23 ON + 8 QB)
- Farms were visited monthly (Apr – Oct) and twice in the winter:
  - Questionnaires about management practices
  - Random selection of 10 adults + 10 ewe-lambs
    - Fecal samples
    - Blood samples
    - Clinical Parameters
      - Pasture samples
      - Necropsy of lambs
## Epidemiology of GIN

<table>
<thead>
<tr>
<th></th>
<th>AVERAGE (min-max)</th>
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<tbody>
<tr>
<td></td>
<td>Certified Organic</td>
<td>Non Certified Organic</td>
<td>Conventional</td>
<td></td>
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<tr>
<td>EWES</td>
<td>118</td>
<td>286</td>
<td>235</td>
<td></td>
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<tr>
<td></td>
<td>(1 - 4660)</td>
<td>(1 -18940)</td>
<td>(1 -9840)</td>
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<tr>
<td>LAMBS</td>
<td>319</td>
<td>424</td>
<td>417</td>
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<tr>
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<td>(1 - 7060)</td>
<td>(1-25020)</td>
<td>(1-14080)</td>
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Table 1. Average fecal egg counts for all ewes and grazing lambs for the total period, by operation type

Note: min = minimum; max = maximum
Fig. 1. Average EWE faecal egg counts (epg) in 32 sheep flocks in Canada (May 2006 – April 2007)
Fig. 2. Average LAMB faecal egg counts (epg) in 32 sheep flocks in Canada (May 2006 – April 2007)
Fig. 3. Pasture infectivity in 32 sheep flocks in Canada (May 2006 – April 2007)
Fig. 4. Faecal egg counts and pasture infectivity in 32 sheep flocks in Canada (May 2006 – April 2007)
Epidemiology of GIN

• **Take-home messages from this study:**
  
  – There was **very large** variation between farms in the burdens of gastrointestinal nematodes both on pasture and in sheep

  – The months with highest fecal egg counts were May-June for ewes and July-August for lambs

  – The average number of infective nematode larvae (L3) recovered from pasture samples showed 2 main peaks: June-July and September
Overwintering of GIN on pasture

• It was previously believed that *H. contortus* does not overwinter on pasture

• However, *H. contortus* larvae were found on pasture in spring in the previous study

• The objective of this study was:
  – To understand whether the population of *H. contortus* larvae overwintering on pasture is a significant source of infection
Overwintering of GIN on pasture

• 3 farms in Ontario were selected
  – Set up data-loggers to measure air and ground temperature, air humidity and soil moisture
  – Soil and pasture samples collected monthly (Nov-Apr)
  – 5 tracer lambs put out to graze for 28 days on 1-acre isolated plots – slaughtered and GI contents collected
Overwintering of GIN on pasture

- **Environmental data** - still to be analysed
- **Soil and pasture samples** – few parasite larvae were found in Nov-Dec
- **Tracer lambs** – *H. contortus* adult worms were found in the abomasum of one lamb from one farm
Overwintering of GIN on pasture

• The take-home messages from this study are:

  – Very few *H. contortus* larvae overwinter on pasture
  – Those that survive have low infectivity
  – Pastures are essentially clean of *H. contortus* in the spring
Sustainable Integrated Parasite Control

1. Regular Monitoring

– Detect high shedders
– Evaluate success of parasite control strategies practiced
  • June (ewes)
  • July (lambs)
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2. Pasture Management Strategies

– 80% of the parasites are in the environment...

a) Crop Rotation

b) Rest Pastures for more than one year (end of June)

c) Low Stocking Densities
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2. Pasture Management

d) Mixed-Species/Rotational Grazing

Cows, Horses...

...not Goats or Camelids
3. Nutrition

• Adequate nutrition ensures proper immune responses towards parasites

• Bypass protein e.g. corn gluten; roasted soybeans

• Especially important in peri-parturient ewes
4. Bioactive Forages

- Some plants are rich in *Condensed Tannins* e.g. Sulla, Chicory, Sanfoin, Birdsfoot trefoil

- Effect may be through increased availability of by-pass protein as well as direct effect on parasites

- May be useful adjuncts for parasite control BUT
  - bioactivity is not specific
  - potentially toxic to sheep
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5. Genetic Resistance

• By Breed:
  – Certain breeds are more resistant
e.g. Gulf Coast Native, Katahdin, St. Croix
  – May have unfavourable side-effects
e.g. lower productivity

• Within breed:
  – No genetic marker
  – Select animals based on reduced fecal egg output and
    higher immune response (detected in saliva)
  – Selection done on large ram groups
6. Copper Oxide Wire Particles

- Several studies to show it reduces infection of *Haemonchus contortus*
  - Temporarily
  - Reduces FEC
  - Doesn’t improve weight gain

- Not effective against other GIN

- Copper toxicity?
7. Antiparasite vaccines

- Work is being done on *H. contortus* vaccines
  - ↓ nematode egg output
  - ↓ worm burden

- However:
  - In Canada we have mixed parasite infections – limited use
  - Not commercially available
Conclusions

• Gastrointestinal nematodes are a problem on many sheep farms in Canada
• Use of multiple control methods should increase the sustainability of parasite control on farms
• Monitor the effectiveness of your control program with your veterinarian