RESULTS OF A DEWORMER RESISTANCE SURVEY IN OKLAHOMA GOAT HERDS

Daniel K. Miller and Terry A. Gipson

E (Kika) de la Garza American Institute for Goat Research
Langston University
Langston, Oklahoma 73050

Introduction

Nematodes are a major health problem for goats, which seem to be less resistant than sheep. Because of their browsing habits, normally goats are unlikely to come into contact with infective larvae, but when forced to graze, as is the common practice on commercial ranches, goats can become heavily infected. The common response on the part of the producer is the use of anthelmintics. These frequent and irregular treatment intervals select for development of parasite resistance to anthelmintics. In the summer of 2003, goat producers in Oklahoma were requested to participate in a dewormer resistance survey. Nine goat producers with sufficient numbers of animals were selected to participate in the dewormer resistance survey (Figure 1).

Procedure

On the initial visit groups of 15 goats were treated orally with either levamisole, albendazole or ivermectin or left untreated (control). The animals were weighed on a livestock scale at the time of treatment and individual fecal samples were collected to determine eggs per gram (EPG). One to two weeks later a second visit was made to collect the follow-up samples. The producers were asked about their parasite control program and the source of their animals.

In all cases the initial mean EPG were more than sufficient to provide adequate comparisons (> 500 EPG). The breeds were mostly Boer and Boer crosses although in one herd there were some LaManchas, in another there were sheep, and a third was composed of Spanish cashmere goats. Ages ranged from yearlings to aged, but in each group an attempt was made to equalize the ages as much as possible. In every case some of the goats had been purchased within the last two years, usually at an auction, but also from private breeders, so that there was always the possibility that in each farm, we were dealing with parasites from different sources.
The EPG were determined by a modified McMaster’s test with a sensitivity of 50 EPG. Fecal egg count reduction results were analyzed using arithmetic means and percent reduction was calculated (TRT = treated animals; CONT = control animals):

\[
\text{% reduction} = 100\left\{1 - \frac{\text{TRT}_{\text{final}}}{\text{TRT}_{\text{initial}}} \times \frac{\text{CONT}_{\text{initial}}}{\text{CONT}_{\text{final}}} \right\}.
\]

**Discussion**

The evidence indicates that in Oklahoma, ivermectin and the benzimidazoles are ineffective, even at increased doses. Only levamisole and moxidectin seem to show any promise as effective anthelmintics, a situation that severely restricts the producers’ options in parasite control because annual rotation of anthelmintics is one of the primary methods of retarding resistance development. Having only one option, or at the most two, does not lend itself well to rotation.

The situation will only get worse in the future as the effective anthelmintics are used excessively, stimulating the development of resistance to them as well. To postpone that day it would be advisable for the producers to begin now with other control measures that reduce the need for chemical control of worms.

The resistance patterns on all the ranches were very homogenous. This suggests that there is a similarity of control programs among the producers as well as a significant amount of animal movement among herds. Because meat goat raising on an intensive scale is relatively new in Oklahoma, and since the Boer breed is also new to the area, to acquire the numbers of goats present, there is a lot of buying and selling with a resultant transfer of nematodes. Most of the purebred raisers supplying the market are in Texas where resistance to all anthelmintics was shown to already be present more than ten years previously, so the transfer of resistant parasites is very likely to have occurred without the necessity to develop indigenous resistant strains. None of the herds that we examined were closed herds.

<table>
<thead>
<tr>
<th>Farm</th>
<th>IVM</th>
<th>ALB</th>
<th>LEV</th>
<th>MOX</th>
<th>MOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>-57.78</td>
<td>43.37</td>
<td>99.04</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>B</td>
<td>18.25</td>
<td>85.31</td>
<td>97.58</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>C</td>
<td>-</td>
<td>3.65</td>
<td>98.54</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>D</td>
<td>54.28</td>
<td>91.42</td>
<td>99.95</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>E</td>
<td>61.74</td>
<td>59.77</td>
<td>92.96</td>
<td>-</td>
<td>1.48</td>
</tr>
<tr>
<td>F</td>
<td>57.36</td>
<td>53.98</td>
<td>98.71</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>G</td>
<td>38.20</td>
<td>74.41</td>
<td>87.66</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>H</td>
<td>-</td>
<td>68.75</td>
<td>99.48</td>
<td>100.00</td>
<td>-</td>
</tr>
<tr>
<td>I</td>
<td>44.20</td>
<td>-</td>
<td>92.08</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

IVM – ivermectin, ALB – albendazole, LEV – levamisole, MOX - moxidectin, MOR - morantel
An area of hope was that the resistant parasites would not be the most pathogenic (*Haemonchus contortus*), so that the anthelmintics that appeared to be ineffective might actually have use against this species even if the other relatively nonpathogenic species were resistant. This was not the case. *Haemonchus contortus* was the most common resistant nematode, a result not unexpected given its reproductive prolificacy compared with the other common species. Because of this, the use of nonanthelmintic control measures is even more necessary than ever.

**Conducting a Fecal Egg Count Reduction Test**

To detect resistance in your herd, a standardized fecal egg count reduction (FECRT) test must be conducted. This section outlines how to conduct a FECRT.

<table>
<thead>
<tr>
<th>How to conduct a FECRT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Begin with a minimum of 24 animals.</td>
</tr>
<tr>
<td>2. Divide animals into a control group and a treatment group</td>
</tr>
<tr>
<td>3. Weigh all animals</td>
</tr>
<tr>
<td>4. Collect fecal samples on all animals</td>
</tr>
<tr>
<td>5. Dose treatment group according to weight</td>
</tr>
<tr>
<td>6. Conduct fecal egg counts on samples from step 4; see training manual below</td>
</tr>
<tr>
<td>7. Collect fecal samples on all animals 7 to 10 days post-treatment.</td>
</tr>
<tr>
<td>8. Conduct fecal egg counts on samples from step 7</td>
</tr>
</tbody>
</table>

Diagnosis of Internal Parasitism in Goats

Dr. Bill Pomroy
Visiting Scholar
Langston University

Also available on the Internet at:

http://www2.luresext.edu/goats/library/goat_library.htm

Step #1

**Fecal Egg Counts**
- There is a relationship between the number of worms and the number of their egg in feces.
- Different types of worms produce different types of eggs.
- All the trichostrongylid worms produce similar eggs which we can’t tell apart.

Step #2

*Normal strongylid egg*
- The main egg type we are interested in when doing counts

Step #3

*Normal strongylid egg with smaller Strongyloides eggs*
- The smaller Strongyloides eggs contain a first stage larvae when they are passed in faeces
McMaster Egg counts
- Most common technique used
- Relies on the use of a floatation fluid in which eggs float and heavier debris in faeces sinks
- Floatation fluid needs to be at least Sp. Gravity of 1.2
- Common floatation media are various salt solutions including
  - Saturated common salt (NaCl)
  - Sodium nitrate (specific gravity of 1.2)
  - Sugar

McMaster slide
- The other key to this technique is the use of a special counting chamber called a McMaster slide
<table>
<thead>
<tr>
<th>Step #6</th>
<th>Step #7</th>
</tr>
</thead>
</table>
| **Tea strainer**  
- 2g of feces is added to 28ml of floatation fluid within the coarse sieve (tea strainer) | **Mixing solution**  
- The feces and fluid are mixed until all the lumps are broken down and the eggs "liberated" |

<table>
<thead>
<tr>
<th>Step #8</th>
<th>Step #9</th>
</tr>
</thead>
</table>
| **Tea strainer removed**  
- The sieve containing coarser material is then removed leaving the floatation media and smaller fecal material including eggs | **Stirring solution**  
- The fluid is then thoroughly stirred with a back and forth motion. If not evenly stirred the eggs come to the surface and you do not end up with a representative count |
Step #10

Filling chambers
• Fill each chamber of the counting slide separately going back and refilling the pipette each time.

Step #11

Counting chambers
• Focus on the gridlines in the chamber which are on the underside of the top slide
• Use the 4X objective lens first and then change to the 10X
• It should then be possible to see a line of each grid on each side of your field of view
• Strongylid eggs are about the same length as the gridlines are wide (don’t confuse with coccidial oocysts
• Count the number of strongylid eggs in each chamber, add them together and multiply by 50 to give you a count of egg per gram of feces
**Recommendations**

- US recommendations are that a cut-off value of 1000 eggs/g indicates the goats need treating
- Goats can die with egg counts of only 2000 eggs/g so be careful
- Haemonchus is a very prolific egg layer with about 6000 per day but Trichostrongylus only produces about 600 per day and Nematodirus many fewer than this
- The immune response can reduce the ability of individual worms to produce eggs so more eggs per worm in young than old, especially with sheep.
The proper citation for this article is: