Internal and External parasite Control Options for Cow/calf Operators

Workshop #4

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Why we treat for parasites

• Reduces productivity of the animal
• Reduces the animal’s ability to utilize its diet
• Well being of animal and us ($$$$)

Mathematics of Parasite Infection

Conservative parasite load  2 eggs/gram
Average fecal production  20 kg/day
Daily production/animal  40,000 eggs

For a 100-cow herd:  4,000,000 eggs/day
Effects of internal parasites

- In general, younger cattle are more susceptible to internal parasites
  - Younger cattle: 100,000 – 1,000,000 worms
- Mature cows can build up an immunity to parasites but recent research indicates the brown stomach worm has developed the capability to evade the cow’s immune system
  - Adult cattle: 100,000 worms

Parasite Signs — Rarely Seen

- Clinical Parasitemia
  - Diarrhea
  - Bottle jaw
  - Anemia
  - Rough hair coat

Subclinical Parasitism
- Reduced weaning weight
- Reduced milk production
- Reduced reproductive performance
- Reduced growth rate
- Increased susceptibility to disease
- Negative effects on immune response

Parasite Populations — Rarely in the Host

- 95% in pasture
- 5% in host

Dr. Bert Stromberg, University of Minnesota
Common Concerns or Questions

• What is the best dewormer to use on my cattle?

• When is the best time of the year to deworm my cattle?

Veterinarians can customize a parasite control program

• programs **MUST** be customized

• therefore, one of the best recommendations I can make for you is to work closely with your veterinarian

• understand the enemy

Important worms

• Roundworms (nematodes)
  – Most important internal parasite in cattle

• Tapeworms (cestodes)
  – Can infect cattle but have minimal effect

• Flukes (trematodes)
  – Region specific and depends on areas with a lot of snails

• Coccida (protozoan)
  – Can be a problem but this talk will focus on worms
Brown Stomach Worm
# 1 Worm
• The infamous Ostertagia is the most economically important parasite in cattle.
• This worm also has a unique ability to penetrate the lining of the true stomach and become dormant, or inhibited, so that it can survive during weather that’s too cold or too hot.
• When conditions improve, the larvae can emerge all at once and do serious damage to the lining of the stomach.

Small Intestinal Worm
# 2 Worm
• While they are found in great numbers, Cooperia are generally thought to contribute secondary effects to the more devastating parasites such as Ostertagia.
• However, some experts are beginning to attribute larger production issues to this parasite.

Small Intestinal Worm
• Data suggested that Cooperia punctata has a negative impact on both appetite and nutrient uptake.
• The non-infected group gained weight 7.4 percent more rapidly ($p=0.02$) than did the infected animals, showing an average daily gain (ADG) of 3.24 pounds versus 3.0 pounds.
• The infected animals also consumed 1.5 pounds per day less per head on a dry matter basis compared to non-infected cattle ($p = 0.02$).
**Small Intestinal Worm**

- Researchers found an average of 24,600 Cooperia worms in the small intestine of the endectocide-treated animal and only 167 in the small intestine of the benzimidazole-treated calf.

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**Why we treat for parasites**

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- Reduces the animal’s ability to utilize its diet
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---

**Parasite’s Life Cycle**

- 3 stages of life cycle
  - developmental stage (outside animal)
  - Pre-adult stage (time from ingestion until capable of producing viable eggs)
    - Also known as prepatent stage
  - adult stage (also known as patent stage)
Developmental Period

- larval development in the environment
- warm, moist conditions favor development
- 3rd stage larvae (L3) = infective larvae
- migrates from manure pat, onto a blade of grass
- ingested when animal grazes

Does Winter Kill Off Parasites?

- Infected larvae on pasture survive winter to reinfect cattle in spring
  - Cold and dry: reduced survivability
  - Cold and snow: survivability is high
- Research shows that parasites can also be transmitted during cold Northern winters

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Dr. Bert Stromberg, University of Minnesota
Developmental Period

(cont'd)

- “spring rise”
- L3 can survive freezing conditions
- eggs survive dry drought conditions

“Spring Rise”

“Pre-Adult” Period

- L3 ingested → digestive tract for further development
- 4th stage larvae (L4)
  - conditions favor further development → next stage
  - if conditions are unfavorable → inhibition may occur
- arrested or inhibited development (hypobiosis)
  - damages digestive tract
  - affects future production
- 5th stage larvae (L5) or young adult
Duration of “Pre-Adult” Period

- young cattle 3 – 4 weeks
- adult cattle 4 – 6 weeks (5 – 6 weeks)
- IMPORTANT when developing a strategic deworming program!

Adult Worms

- mature adults
- male & female mate
- produce fertile eggs (ova)
- cycle continues

Pasture Contamination – A Vicious Cycle - Southern US
Deworming Programs (3 types)

- therapeutic program
- tactical program
- strategic program

Therapeutic Program

- treat clinical disease
- does nothing to minimize pasture contamination

Tactical Program

- treat or administer medicine when it is convenient for the producer
- does nothing to minimize pasture contamination
Strategic Program

- definition: program to allow young cattle to graze “parasite safe” pastures for approximately 90 days
- early in the grazing period

- Remember our goal is not to eliminate worms but to sell lbs. of calves

Strong Demand and Markets Make Strategic Program Hard to Ignore

- High demand and high prices raise the stakes
- Every pound of production is worth more
- It gets harder for all producers to ignore the value of strategic program

Adult Cows

- individual performance benefit in adult animals is difficult to justify

- HOWEVER, adults grazing with young stock contribute to pasture contamination
- deworm adult cattle to reduce challenge to young stock
Adult Cows
(cont’d)
• if dewormed previous fall or winter & likelihood of acquiring infection is minimal, then assume adults fairly clean at turn out
• if deworming history is unknown or adults probably infected, deworm at turn out

Adult Cows
(cont’d)
• deworm 4 – 6 weeks (if used medicine with no residual killing activity)
• 6 weeks plus 6 weeks = approx 90 days
• generally deworm after grazing (late fall, winter)
  – generally consider fairly clean at turn out

Young Cattle
• How early should calves be dewormed?
  • Rule Of Thumb:
    – 2 months of age or calves that weigh ≥ 200 pounds
Young Cattle (cont’d)

- if medicine does not have any residual killing activity, calves will need to be dewormed again at 4 weeks
- AND at another 4 weeks
- provides approximately 90 days of grazing
- if the medicine has residual activity, then add the residual time to the 4 week intervals

Cattle are Hosts – and Multipliers

- Dr. Bert Stromberg, University of Minnesota

Dewormer Resistance

- Means we will have to rely on techniques other than dewormers to control worms
- Animal selection
- Pasture rotation
- Low stocking rates, etc
What Is Dewormer Resistance?

- An effective dewormer will reduce fecal egg counts by 95% 7-14 days after giving the dewormer
- Fecal Egg Count before deworming 1,000 eggs per gram
- 10 days after deworming 200 eggs per gram = 80% fecal egg count reduction

Levels at which worm resistance to anthelmintics is effected

1. Farm level practices
   - Do not weigh animals when we treat
   - Underdose animals then stipulating to resistance
   - Too much pour-on (80% of products available)

2. Product to product variations
   - Generics vs. trade name products

3. Animal to animal differences
   - Identical animals showed a 30-40% variation of how much product gets to the worm

4. Worm behavioral adaptation to the chemicals

5. Molecular changes in the worms
   - Certain molecules can detoxify the chemical
Pour-on Ivermectins

(Yazwinski et al. 2004)

% reduction of egg counts by treatment group at 14 & 56 days post trt.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>14 days</th>
<th>56 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ivermectin Pour-on</td>
<td>99</td>
<td>98</td>
</tr>
<tr>
<td>Tap Line</td>
<td>81</td>
<td>86</td>
</tr>
<tr>
<td>Cooper MEC</td>
<td>85</td>
<td>87</td>
</tr>
<tr>
<td>Ivermectin Pour-on</td>
<td>87</td>
<td>95</td>
</tr>
<tr>
<td>Control</td>
<td>95</td>
<td>95</td>
</tr>
</tbody>
</table>

Deworming Program for Cattle

<table>
<thead>
<tr>
<th>Animal</th>
<th>Time of Treatment</th>
<th>Recommended Product Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mature cows</td>
<td>Roast handpicking</td>
<td>Baermann's fluid (Oct 30, Apr 15)</td>
</tr>
<tr>
<td>Bulls</td>
<td>Spring and fall</td>
<td>Baermann's fluid (Oct 30, Apr 15)</td>
</tr>
<tr>
<td>Calves</td>
<td>3-4 months of age</td>
<td>Ivermectin or Milbemycin</td>
</tr>
<tr>
<td>Replacement and stockers</td>
<td>Weekly applications and at springfall (treatment)</td>
<td>Ivermectin or Milbemycin</td>
</tr>
<tr>
<td>Sheep and goats</td>
<td>Weekly treatments and every 3-4 months until pregnancy</td>
<td>Ivermectin or Milbemycin</td>
</tr>
<tr>
<td>Ewes</td>
<td>Spring and fall</td>
<td>Ivermectin or Milbemycin or Baermann's fluid</td>
</tr>
</tbody>
</table>

External Parasites
Factors to Consider before Controlling Pests:

- Economic Threshold
  - Animals in good body condition can tolerate higher populations of pests before economic injury occurs.
- Pesticide Resistance
  - Many products are no longer as effective as they once were.
- Pest Biology
  - Reproductive potential of pest.
- Knowledge of Pesticide Classes
  - Rotate products.

Estimated Economic Losses in U.S. Cattle Due to Arthropods

<table>
<thead>
<tr>
<th>Arthropod</th>
<th>Estimated Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horn Flies</td>
<td>$1.36 billion</td>
</tr>
<tr>
<td>Stable Flies</td>
<td>$672 million</td>
</tr>
<tr>
<td>Horse Flies</td>
<td>$296 million</td>
</tr>
<tr>
<td>Face Flies</td>
<td>$191 million</td>
</tr>
<tr>
<td>Ticks</td>
<td>$162 million</td>
</tr>
<tr>
<td>Mosquitoes</td>
<td>$78 million</td>
</tr>
<tr>
<td>Lice</td>
<td>$59 million</td>
</tr>
</tbody>
</table>

Based on Kunz et al 1991 and adjusted for inflation rates

Horn Flies

- Considered the most important external parasite of cattle
- With high summertime populations, they cause cattle to lose weight and lower milk production
- Economic infestations range from 200 to 300 or more flies per animal and usually develop in late May or June and then persist into the fall
- Horn flies reduce beef production efficiency and the economic loss is manifested in growing cattle
- Normally, growing cattle gain an extra 1.5 pounds per week when horn flies are controlled
- Horn flies are a greater problem in pastured cattle because they require a fresh, intact manure pad to complete their life cycle
Influence of horn fly infestations on physiological measurements of beef steers.\textsuperscript{a}

<table>
<thead>
<tr>
<th>Item</th>
<th>0</th>
<th>250</th>
<th>500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart rate /min\textsuperscript{b}</td>
<td>76.6</td>
<td>89.1</td>
<td>101.1</td>
</tr>
<tr>
<td>Respiration rate /min\textsuperscript{b}</td>
<td>46.6</td>
<td>52.7</td>
<td>62.1</td>
</tr>
<tr>
<td>Rectal Temp., °F\textsuperscript{b}</td>
<td>103.8</td>
<td>103.2</td>
<td>102.4</td>
</tr>
<tr>
<td>Water intake, gd./day</td>
<td>4.4\textsuperscript{d}</td>
<td>4.3\textsuperscript{d}</td>
<td>6.6\textsuperscript{d}</td>
</tr>
<tr>
<td>Urine output, gd./day</td>
<td>1.0\textsuperscript{d}</td>
<td>1.1\textsuperscript{d}</td>
<td>3.2\textsuperscript{d}</td>
</tr>
<tr>
<td>Feed intake, lbs. DM/day</td>
<td>12.4</td>
<td>12.4</td>
<td>12.4</td>
</tr>
<tr>
<td>Nitrogen intake, grams/day</td>
<td>30.5</td>
<td>34.5</td>
<td>34.8</td>
</tr>
<tr>
<td>Fecal nitrogen, grams/day</td>
<td>24.4\textsuperscript{d}</td>
<td>31.2\textsuperscript{d}</td>
<td>34.7\textsuperscript{d}</td>
</tr>
<tr>
<td>Nitrogen retained, grams/day</td>
<td>63.6\textsuperscript{d}</td>
<td>50.3\textsuperscript{d}</td>
<td>49.5\textsuperscript{d}</td>
</tr>
</tbody>
</table>

\textsuperscript{a} Byford et al., 1992 and Schwinghammer et al., 1986
\textsuperscript{b} Row values differ (P = 0.05)
\textsuperscript{c,d} Row values differ with different superscript (P = 0.05)

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Horn fly insecticide resistance management

1. Begin horn fly control procedures in the spring when cattle average approximately 200 horn flies.

2. If ear tags are used, the insecticide classes must be rotated. Do not use a pyrethroid ear tag more than once every three years. Do not use an organophosphate ear tag more than two years in succession. Continuous use of ear tags in the same insecticide class will eventually result in horn fly resistance.

3. Remove ear tags at the end of the fly season or when they lose their effectiveness. Do not tag cattle more than once per fly season, regardless of insecticide class.
Horn fly insecticide resistance management (cont.)

4. If additional horn fly control is needed later in the year, use sprays, pour-ons, dusts or backrubbers. If possible, alternate insecticide classes when changing control methods.

5. If pyrethroid ear tags have failed to control horn flies in the previous year, pyrethroid insecticides in any form should not be used for at least two years. In the meantime, use non-pyrethroid ear tags, sprays, pour-ons, etc.

Pyrethroid Tags:  Organophosphate Tags:
No more than once every three years  Do not use more than two years in a row

Ideal Rotation for Horn Fly Control

• Abamectin → Organophosphate → Pyrethroid

• Why?
  - Cholinesterase inhibitors (OP) Resistance Group 1 (Corathon)
  - Sodium Channel Modulators (P) Resistance Group 3 (Cylence Ultra)
  - Chloride Channel Modulators (Ab) Resistance Group 6 (not listed)

Organophosphate Products (OP)

<table>
<thead>
<tr>
<th>Brand Name</th>
<th>Active Ingredient</th>
<th>Color</th>
<th>Applicator gun</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warrior</td>
<td>30% Diazinon, 10% Chlorpyrifos</td>
<td>Green</td>
<td>Y-Tex</td>
</tr>
<tr>
<td>Optimizer²</td>
<td>21.4% Diazinon</td>
<td>Orange</td>
<td>Y-Tex</td>
</tr>
<tr>
<td>Dominator</td>
<td>20% Pirimiphos</td>
<td>Yellow</td>
<td>Allflex</td>
</tr>
<tr>
<td>Patriot</td>
<td>40% Diazinon</td>
<td>Orange</td>
<td>Allflex</td>
</tr>
<tr>
<td>Terminator II</td>
<td>20% Diazinon</td>
<td>Red</td>
<td>Allflex</td>
</tr>
<tr>
<td>Corathon</td>
<td>15% Coumaphos, 10% Diazinon</td>
<td>Slate Green</td>
<td>Allflex</td>
</tr>
<tr>
<td>Double Barrel VP</td>
<td>6.8% Lambda-cyhalothrin, 14% Pirimiphos Methyl</td>
<td>Red</td>
<td>Allflex</td>
</tr>
</tbody>
</table>

² Not cleared for use on Calves
### Pyrethroid Products (P)

<table>
<thead>
<tr>
<th>Brand Name</th>
<th>Active Ingredient</th>
<th>Color</th>
<th>Applicator gun</th>
</tr>
</thead>
<tbody>
<tr>
<td>Python</td>
<td>20% Piperonyl Butoxide 10% Zetacypemethrin</td>
<td>Lavender</td>
<td>Y-Tex</td>
</tr>
<tr>
<td>Python Magnum</td>
<td>20% Piperonyl Butoxide 10% Zetacypemethrin</td>
<td>Blue</td>
<td>Y-Tex</td>
</tr>
<tr>
<td>Gardistar Plus</td>
<td>10% Permethrin</td>
<td>Red</td>
<td>Y-Tex</td>
</tr>
<tr>
<td>Saber Extra</td>
<td>10% LambdaCyhalothrin</td>
<td>Purple</td>
<td>Allflex</td>
</tr>
<tr>
<td>CyLance Ultra</td>
<td>Synergized Pyrethroid</td>
<td>Light Blue</td>
<td>Allflex</td>
</tr>
</tbody>
</table>

### Macrocylic Lactone

<table>
<thead>
<tr>
<th>Brand Name</th>
<th>Active Ingredient</th>
<th>Color</th>
<th>Applicator gun</th>
</tr>
</thead>
<tbody>
<tr>
<td>XP 820 (Ab)</td>
<td>Macrocyclic lactone Abamectin Piperonyl Butoxide</td>
<td>Gold</td>
<td>Y-Tex</td>
</tr>
</tbody>
</table>

### 100+ Flies
Experimental Design

<table>
<thead>
<tr>
<th>Brand Name</th>
<th>Active Ingredient</th>
<th>Insecticide Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>VetGun</td>
<td>1% Neomycin</td>
<td>1% Chlorpyrifos</td>
</tr>
<tr>
<td>Corathon</td>
<td>1% Cypermethrin</td>
<td>Organophosphate</td>
</tr>
<tr>
<td>Python</td>
<td>5% Cypermethrin</td>
<td>Organophosphate</td>
</tr>
<tr>
<td>Magnum</td>
<td>5% Cypermethrin</td>
<td>Organophosphate</td>
</tr>
<tr>
<td>Cylence</td>
<td>5% Cypermethrin</td>
<td>Organophosphate</td>
</tr>
<tr>
<td>Ultra</td>
<td>5% Cypermethrin</td>
<td>Organophosphate</td>
</tr>
<tr>
<td>VetGun</td>
<td>5% Cypermethrin</td>
<td>Organophosphate</td>
</tr>
<tr>
<td>XP 820</td>
<td>5% Cypermethrin</td>
<td>Organophosphate</td>
</tr>
</tbody>
</table>

Results

![Graph showing experimental results](image)

Cost Comparison

**VetGun**
- Retail Prices:
  - VetGun kit – approximately $249
  - AIM L-VetCaps 30ct – approximately $78.60 (2.62 per dose)
  - AIM L-VetCaps 150ct – approximately $298 (1.99 per dose)
  - If treatment of horn flies begins in June then consider having to apply at least three times throughout the horn fly season and cost will be: $4.50 – 4.75 /hd

**Ear Tag**
- Retail Prices:
  - Best tagging method is to put two tags per animal
  - Good tags that performed well in last year’s ear tag trial are averaging: $4.30 – 4.80 /hd
Fly Control Cost

<table>
<thead>
<tr>
<th>Product</th>
<th>XP 820</th>
<th>Cylence Ultra</th>
<th>Corathon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active Ingredient</td>
<td>Alabamectin</td>
<td>5th Gen. Pyrethroid</td>
<td>Organophosphate</td>
</tr>
<tr>
<td>Price per Head (hd)</td>
<td>$4.30 / hd</td>
<td>$4.40 / hd</td>
<td>$4.40 / hd</td>
</tr>
<tr>
<td>Cattle Rub Application/ 5 months</td>
<td>$1.75 / hd</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Two tags applied per animal.

Best Management Practice

2 R’s

- Rotate
- Remove

- Don’t use more than one product per herd

Lone Star Tick

- Three-host tick
- All life stages attack cattle
- Can be a severe pest from March until August
- Female is capable of laying 9,000 – 12,000 eggs
- Control is achieved by vegetation management and the use of various insecticides
Anaplasmosis and external parasites

- Up to 19 different tick vector species (including Boophilus, Dermacentor, Rhipicephalus, Ixodes, Hyalomma, and Ornithodoros) have been reported to transmit Anaplasma spp. Not all of these are likely significant vectors in the field, and it has been shown that strains of *A. marginale* also co-evolve with particular tick strains.
- *Dermacentor* spp have been incriminated as the main vectors in the USA.
- Mechanical transmission via biting horse flies occurs in some regions.