Evaluation of Horn Flies and Internal Parasites with Growing Beef Cattle Grazing Bermudagrass Pastures

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Findings

- Treating for both horn flies and internal parasites resulted in improved stocker growth even with marginal levels of fly control.
- Averaged over the three trials, stockers treated for control of both horn flies and internal parasites responded with approximately a 29 pound total weight gain advantage.
- At current prices, investing the cost for both treatments would result in over a four-fold return for beef stocker producers.

Introduction

The cow-calf production system is the primary beef cattle enterprise in the southeastern United States. A high percentage of calves produced in this region are sold at weaning to stocker operators who carry them through the growing or stockering phase in other sections of the country. Higher forage production due to the relatively long growing seasons, adequate rainfall and soils that readily respond to fertilization gives the southeastern United States, including Louisiana, an advantage over other regions of the nation for stocker production.

The horn fly, *Haematobia irritans* (L.), is one of the major blood-sucking pests of cattle. It can be found year-round in southern regions of the United States, but peak populations occur in the spring, summer and early fall. These times coincide with the stocker grazing of warm-season forages such as bermudagrass.

Gastrointestinal (GI) nematodes are the most common internal parasites affecting cattle. Young, growing cattle are most susceptible to GI nematode infestations.

Although there have been numerous studies demonstrating improved growth performance with external or internal parasite control separately for stocker production. There is a lack of research investigating the combined effects of both horn fly and GI nematode control on stocker grazing production. The objective of this study was to assess the effects of horn fly and internal parasite control on stocker performance while grazing bermudagrass pastures.

Materials and Methods

Three trials were conducted at the Hill Farm Research Station. Trial 1 was conducted from 17 May 2005 to 9 August 2005 (84 days; 12 weeks). Trial 2 was performed from 10 May 2006 to 16 August 2006 (98 days; 14 weeks). Trial 3 began 3 May 2007 and ended 23 August 2007 (112 days; 16 weeks).

In all three trials, the groups of cattle were grazed on one of eight 2-acre Coastal and Common Bermudagrass pastures separated by permanent electric or barb- and net-wire fencing. Pastures used in all three trials had been grazed by cattle infected with GI nematodes before initiation of each trial. All pastures received identical fertilizer applications and clipping management.

Angus-sired (12.5 to 25% Brahman inheritance) weaned (7-9 month old heifers and steers) stocker calves were utilized for each of the three trials. A total of 168 calves were used (56 per trial). These
calves were weaned in April of each year, about a month before the start of each trial. Body weight averages at the initiation of trials 1, 2 and 3 were 560, 562 and 559 pounds, respectively. Cattle were identified by individual ear tags and given recommended vaccinations for infectious diseases. Stockers were pastured together prior to the initiation of each trial.

Stockers were stratified by sex and weight and randomly assigned to eight replicate treatment groups. The four treatments were: 1) control, no treatment for horn flies or GI nematode (CON); 2) treatment for horn flies with insecticidal ear tags applied (HF); 3) treatment for GI nematodes with an anthelmintic (GN); and 4) treatment for both horn flies and GI nematodes as stated above for HF and GN treatments (HF-GN). Each replicate treatment group was composed of seven stockers (14 stockers per treatment) and grazed 2-acre pastures, resulting in a stocking rate of 3.5 stockers per acre for all three trials. Groups were rotated among the eight pastures every 2 weeks to minimize possible pasture effects.

At the initiation of each trial, stockers assigned to the HF and HF-GN treatments were fitted with one insecticide-impregnated ear tag (IET). In addition to the IET, an insecticidal spray (used in trial 1) and pour-on (used in trials 2 and 3) were applied to the treated groups in July and August for additional fly control.

Each week throughout the three trials, estimates of the number of horn flies per side were conducted for five randomly selected stockers in each replicate group. All counts were made before 0830 with the aid of binoculars.

On days 0, 28 and 56 in trial 1 and days 0, 28, 56 and 84 in trials 2 and 3, stockers assigned to GN and HF-GN treatments received fenbendazole oral drench. In each of the three trials, rectal fecal samples were individually collected from all cattle for determination of GI nematode fecal eggs count (FEC) values and are reported as eggs per gram (EPG). Rectal fecal samples were collected from all cattle on days 0, 14 (efficacy assessment), 28, 56, 70 (efficacy assessment), 84, 98 (trial 2 only) and 112 (trial 3 only). Efficacy of deworming was determined by FEC reduction test ((untreated FEC - treated FEC) / untreated FEC) * 100.

In all three trials, cattle were weighed on two consecutive days at the beginning of each trial with the average of these two weights being recorded. Likewise, at the end of each trial, cattle were weighed on two consecutive days with the average of these two weights being recorded. In all three trials, cattle were weighed at 28-day intervals during the trial periods.

Horn fly counts, FEC and animal performance data were analyzed separately for each year or trial. Fly counts were analyzed using GLM procedures of SAS. Fecal egg counts were transformed to the natural logarithm of (count +1) to determine treatment mean differences (log FEC). Fecal egg count values and log FEC values were analyzed using the repeated measures of the GLM procedure of SAS. Body weight (BW) and average daily gain (ADG) were analyzed using MIXED procedures of SAS. Pre-planned treatment mean contrasts were constructed (CON vs. HF, CON vs. GN and CON vs. HF-GN) to determine treatment differences for BW and ADG. In all analyses, a significant difference was defined as a P-value of <0.05 for a confidence level of 95%.

Results and Discussion

In all three trials, stockers treated for horn flies (HF and HF-GN) had lower (P < 0.05) weekly horn fly counts compared with untreated stockers (CON and GN). The overall weekly counts for the treated stockers averaged 55, 43 and 56 flies per side in trials 1, 2 and 3, respectively, whereas the untreated stockers averaged
90, 156 and 107 flies per side for trials 1, 2 and 3, respectively. The accepted economic threshold of 100 flies per side was exceeded for the untreated groups for five, 11 and 11 weeks in trials 1, 2 and 3, respectively. For the treated groups, fly counts exceeded over 100 flies per side for one, one and zero weeks in trials 1, 2 and 3, respectively. The levels of horn fly control for the treated stockers were lower than expected in trials 1 and 3. Relative to CON stockers, the reduction in horn fly populations for the treated stockers was 40% in trial 1 and 48% in trial 3. In trial 2, more effective control was achieved (70%). A probable explanation for these marginal levels of control could be due to the development of resistance to insecticides by the horn flies.

There were no weight gain advantages for the stockers treated for horn flies alone (Table 1). A possible explanation for this lack of weight gain response from horn fly treatment may be threefold. First, as explained above, the level of fly control for the treated stockers was marginal. Secondly, the overall horn fly population on the untreated stockers was below the economic threshold in trial 1 (90 flies per side) and just over the threshold in trial 3 (107 flies per side). Thirdly, the magnitude of weight gain of the stockers in this study was relatively low. Possibly further contributing to these reduced rates of gain in this study was the limited rainfall during the trial periods, particularly in trials 1 and 2, which resulted in limited forage availability toward the end of these trials.

Stockers in trial 1 treated with fenbendazole on days 0, 28 and 56 had lower ($P < 0.01$) FEC on days 14 and 70 than untreated stockers. In trials 2 and 3, stockers treated with fenbendazole on days 0, 28, 56 and 84 had lower ($P < 0.01$) FEC compared with untreated stockers on all collections except for the initial collection on day 0. Based on efficiency assessment collections (days 14 and 70), fecal egg count reductions ranged from 95% to 100% for all three trials indicating that fenbendazole was effective in reducing GI nematode infections. Even with these reductions in fecal EPG, we found no significant weight gain response for the stockers treated for GI nematodes alone (GN) compared with CON stockers (Table 1). The overall lower rates of gain experienced in our study may have contributed to the lack of significant differences between treated and untreated stockers.

Stockers treated for both horn flies and GI nematodes (HF-GN) responded with increased ($P < 0.05$) daily weight gains (0.29 and 0.52 lbs) compared with non-treated stockers (CON) in trials 1 and 2 (Table 1). These improved weight gains resulted in 24 and 51 lbs of additional total weight gains in trials 1 and 2, respectively. With these improved weight gains, there were economic incentives to consider. The cost of treating for both horn flies and GI nematodes was approximately $6.75 for each stocker (excluding labor), which is far less than the value of approximately 29 lbs of added weight gain (average over the three trials) that resulted from these treatments.
**Table 1. Growth performance of stockers.**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Trial 1</th>
<th></th>
<th></th>
<th>Trial 2</th>
<th></th>
<th></th>
<th>Trial 3</th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Initial weight, lb</td>
<td>ADG, lb</td>
<td>Final weight, lb</td>
<td>Initial weight, lb</td>
<td>ADG, lb</td>
<td>Final weight, lb</td>
<td>Initial weight, lb</td>
<td>ADG, lb</td>
<td>Final weight, lb</td>
</tr>
<tr>
<td>Control</td>
<td>564</td>
<td>0.82</td>
<td>632</td>
<td>564</td>
<td>0.76</td>
<td>639</td>
<td>559</td>
<td>0.99</td>
<td>669</td>
</tr>
<tr>
<td>Horn fly (HF)</td>
<td>558</td>
<td>0.80</td>
<td>623</td>
<td>564</td>
<td>1.04</td>
<td>666</td>
<td>559</td>
<td>0.98</td>
<td>669</td>
</tr>
<tr>
<td>GI nematode (GN)</td>
<td>558</td>
<td>1.01</td>
<td>642</td>
<td>560</td>
<td>1.05</td>
<td>663</td>
<td>560</td>
<td>1.03</td>
<td>675</td>
</tr>
<tr>
<td>HF-GN</td>
<td>559</td>
<td>1.11</td>
<td>650</td>
<td>562</td>
<td>1.28</td>
<td>688</td>
<td>559</td>
<td>1.10</td>
<td>682</td>
</tr>
<tr>
<td>S.E.</td>
<td>11.1</td>
<td>0.09</td>
<td>15.2</td>
<td>21.9</td>
<td>0.14</td>
<td>29.8</td>
<td>11.2</td>
<td>0.10</td>
<td>11.8</td>
</tr>
<tr>
<td>Contrasts</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Control vs. HF</td>
<td>6.4</td>
<td>0.02</td>
<td>8.4</td>
<td>-5.6</td>
<td>-0.28</td>
<td>-26.7</td>
<td>0.5</td>
<td>0.01</td>
<td>0.8</td>
</tr>
<tr>
<td>Control vs. GN</td>
<td>6.1</td>
<td>-0.19</td>
<td>-10.3</td>
<td>-4.4</td>
<td>-0.29</td>
<td>-24.2</td>
<td>-0.9</td>
<td>-0.04</td>
<td>-5.3</td>
</tr>
<tr>
<td>Control vs. HF-GN</td>
<td>5.2</td>
<td>-0.29*</td>
<td>-18.6</td>
<td>6.1</td>
<td>-0.52*</td>
<td>-49.1*</td>
<td>0.3</td>
<td>-0.11</td>
<td>-12.4</td>
</tr>
<tr>
<td>S.E.</td>
<td>15.1</td>
<td>0.11</td>
<td>19.5</td>
<td>16.3</td>
<td>0.20</td>
<td>19.3</td>
<td>13.8</td>
<td>0.12</td>
<td>16.7</td>
</tr>
</tbody>
</table>

*a* Control = no treatment for horn flies or GI nematode; HF = treated for horn flies; GN = treated for GI nematodes; HF-GN = treated for both horn flies and GI nematodes.

*b* Average standard error of the treatment means or contrasts.

* * P < 0.05.
Evaluation of Horn Flies and Internal Parasites with Spring Calving Cows and Calves

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Findings

- Treating for both horn flies and internal parasites resulted in improved preweaning calf growth even with marginal levels of fly control.
- A greater response in calf growth resulted when deworming calves at 4 to 5 months of age rather than at 2 to 3 months of age.
- Calves that were treated for internal parasites and whose dams were treated for horn flies were approximately 22 lbs heavier than untreated calves at weaning.
- At current prices, investing the cost for both treatments would result in over a four-fold return for beef cow-calf producers.

Control of internal parasites affecting cattle may have significant beneficial effects related to productivity of beef cattle. Cattle of all ages, but particularly young cattle, are infected by a diversity of internal parasites. Gastrointestinal (GI) nematodes are the most common internal parasites affecting cattle, and they can cause significant production losses in the hot and humid regions of the United States including Louisiana. Weather patterns of these regions at times provide ideal conditions for GI nematode infestations of pastured cattle. It is estimated that $2.5 billion is spent on pharmaceutical products by the cattle industry for control of internal parasites.

There have been numerous studies demonstrating the economic benefits of external or internal parasite control separately for cow-calf production; however, there is a lack of research investigating the combined effects of both horn fly and GI nematode control on cow-calf production. The objective of this study was to assess the effects of horn fly and internal parasite control on cow-calf production in a spring calving system.

Introduction

The cow-calf production system is the primary beef cattle enterprise in the southeastern United States. External and internal parasites can adversely impact overall performance of a cow-calf enterprise. The horn fly is the major blood-sucking external parasite of cattle in Louisiana. Annual economic losses from horn fly infestations for cattle production in the United States have been estimated to be $876 million. Horn flies feed up to 20 times daily on cattle causing stress and annoyance, which may result in reductions of milk production and calf growth. Horn flies can be found year-round in southern regions of the United States; however, peak populations occur in the spring, summer and early fall, which coincides with the preweaning phase of a spring-calving cow-calf system.

Material and Methods

Two trials (2005 and 2006) were conducted at the Hill Farm Research Station in north Louisiana and at Reproductive Biology Center in south Louisiana. Each of the trials began in late-May and concluded in late-September to early-October when the calves were weaned. Length of the trials ranged from 115 to 124 days. The study groups of cattle grazed on pastures that were deemed adequate for available warm-season forages at all times during the study. All pastures within each location received identical fertilizer applications and clipping management.
There were a total of 508 cow-calf records available for study. At the Hill Farm Research Station breed type of cows were Angus- or Hereford-influenced with 25 to 50% Brahman inheritance. Calves were sired by Angus or Charolais bulls. Breeding season lasted from May 1 to June 30, resulting in calves being born from early-February through early-April. Breed type of cows at the Reproductive Biology Center were Brangus-, Continental- (Gelbvieh or Simmental) or Red Angus-influenced with 12.5 to 50% Brahman inheritance. Calves were sired by Red Angus, Hotlander (composite of Brahman, Red Angus, Senepol and Simmental breeds) or Senegus (composite of Red Angus and Senepol breeds) bulls. Breeding season occurred from April 15 to June 30, resulting in calves being born from mid-January through early-April.

The four treatments were: 1) control, no treatment for horn flies or GI nematode (CON); 2) treatment for horn flies with insecticidal ear tags applied to cows only (HF); 3) treatment for GI nematodes with an anthelmintic (oral drench of fenbendazole) administered to calves only (GN); and 4) treatment for both horn flies and GI nematodes as stated above for HF and GN treatments (HF-GN). At each location, groups were rotated among the pastures to minimize possible pasture effects.

At the initiation of each trial, cows assigned to the HF and HF-GN treatments were fitted with one insecticide-impregnated ear tag (IET). In addition to the IET, an insecticidal spray (trial 1) and pour-on (trial 2) were applied to the treated groups in July, August and September for additional fly control at each location. Each week throughout the two trials, estimates of the number of horn flies per side were conducted for ten randomly selected cows in each treatment group. All counts were made before 0830 with the aid of binoculars.

In late-May, mid-July and late-August (about 40-45 days apart), calves assigned to GN and HF-GN treatments received an oral drench of fenbendazole. Rectal fecal samples were individually collected from all calves for determination of nematode fecal egg count (FEC) values and are reported as eggs per gram (EPG). Rectal fecal samples were collected in late-May, mid-July, late-August, weaning and 10 to14 days after late-May and late-August treatments to access anthelmintic efficacy. Efficacy of deworming was determined by FEC reduction test ((untreated FEC - treated FEC) / untreated FEC) * 100.

Cows and calves were weighed and cow body condition score (BCS) determined (using the scoring system with 1 = emaciated and 9 = obese) at the beginning of each trial in late-May, mid-July and weaning. Cows were rectally palpated at weaning to determine pregnancy status. Horn fly counts, FEC and animal performance data were analyzed separately for each year or trial. Due to significant location effects, horn fly counts and FEC were analyzed separately by location. Fly counts were analyzed using GLM procedures of SAS. Fecal egg counts were transformed to the natural logarithm of (count +1) to determine treatment mean differences (log FEC). Fecal egg count values and log FEC values were analyzed using the repeated measures of the GLM procedure of SAS. Calf body weight (BW), BW gain and cow BW, BW change, BCS, BCS change and pregnancy rate were analyzed using MIXED procedures of SAS. Pre-planned treatment mean contrasts were constructed (CON vs. HF, CON vs. GN and CON vs. HF-GN) to determine treatment differences for calf growth and cow performance. In all analyses, a significant difference was defined as a P-value of <0.10 or <0.05 for a confidence level of 90 and 95%, respectively.

**Results and Discussion**

Cows treated for horn flies (HF and HF-GN) at the Hill Farm Research Station had lower ($P < 0.05$) weekly horn fly counts compared with untreated cows (CON and
The overall weekly counts for the treated cow groups averaged 88 and 74 flies per side for trials 1 and 2, respectively, whereas the untreated cow groups averaged 120 and 186 flies per side for trials 1 and 2, respectively. The accepted economic threshold of 100 flies per side was exceeded for the treated groups for 7 and 5 weeks for trials 1 and 2, respectively. The levels of horn fly control for the treated cows (HF and HF-GN) at this location were lower than expected, especially in trial 1. A probable explanation could be due to the development of resistance to insecticides by the horn flies. At the Reproductive Biology Center, cows treated for horn flies had lower ($P < 0.05$) weekly horn fly counts compared with untreated cows. The overall weekly counts for the treated cows averaged 44 and 40 flies per side for trials 1 and 2, respectively, whereas the untreated cows averaged 164 and 136 flies per side for trials 1 and 2, respectively. The economic threshold of 100 flies per side was exceeded for the treated groups for 1 and 3 weeks for trials 1 and 2, respectively. Calf growth performance in response to horn fly control alone resulted in no significant weight gains in trial 1 (Table 1); however, in trial 2 calves with dams treated for horn flies had 19.1 lbs greater total gains ($P < 0.05$) than CON calves (Table 2).

Calves treated with fenbendazole had lower ($P < 0.01$) FEC for post late-May collection and post late-August collection than untreated calves. Fecal egg count reductions ranged from 96 to 100%, indicating that fenbendazole was effective in reducing GI nematode infestations. Furthermore, the treated calves had lower ($P < 0.01$) overall FEC (average of six FEC collections) at both locations. The GN-treated calves had either numerically (trial 1) or significantly (trial 2) greater total gains compared with CON calves (Tables 1 and 2). In both trials, GN calves compared with CON calves, responded with greater body weight gain differences from mid-July to weaning than from late-May to mid-July. These results suggest that a greater response in calf growth should be expected when treating calves 4 to 5 months of age rather than 2 to 3 months of age.

In trial 1, weight gains from mid-July to weaning and total gain for HF-GN calves were numerically greater than CON calves (Table 1). In trial 2, weight gains from mid-July to weaning and total gains were greater ($P < 0.05$) for HF-GN calves compared with CON calves (Table 2). The HF-GN treated calves ranked the highest among the treatment groups in total gain in both trials.

With these improved weight gains resulting from horn fly and internal parasite control, there were economic incentives to consider. The cost of treating for both horn flies and GI nematodes was approximately $4.53 for each cow-calf pair (excluding labor) which is far less than the value of approximately 22 lbs of added calf weight gain that resulted from these treatments. At current prices, investing the cost for both treatments would result in over a four-fold return for beef cow-calf producers.

There were no significant treatment effects for any of the cow response traits (body weight, body condition score, body weight change, body condition score change and pregnancy rate) in both trials. There appeared to be no apparent trends or tendencies of these traits influenced by treatment.

**Acknowledgements**

Appreciation is expressed to Pat DeRouen, Lee Faulk, Mike Kearney, Brooke Leibenguth, Jared Pitchford, Gorden Reger, Mike Turpin, Brandon Weeks and Cole Younger for technical assistance.
Table 1. Calf growth performance - Trial 1.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Initial weight, lb</th>
<th>Late-May to mid-July gain, lb</th>
<th>Mid-July to weaning gain, lb</th>
<th>Total gain, lb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>304</td>
<td>92</td>
<td>154</td>
<td>246</td>
</tr>
<tr>
<td>Horn fly (HF)</td>
<td>303</td>
<td>95</td>
<td>147</td>
<td>242</td>
</tr>
<tr>
<td>GI nematode (GN)</td>
<td>304</td>
<td>88</td>
<td>170</td>
<td>258</td>
</tr>
<tr>
<td>HF-GN</td>
<td>305</td>
<td>99</td>
<td>166</td>
<td>265</td>
</tr>
<tr>
<td>S.E.⁺</td>
<td>5.7</td>
<td>4.3</td>
<td>7.6</td>
<td>8.9</td>
</tr>
</tbody>
</table>

Contrasts

Control vs. HF | 1.3 | -3.0 | 7.1 | 4.1 |
Control vs. GN | -0.6 | 3.7 | -15.8 | -12.1 |
Control vs. HF-GN | -1.2 | -6.7 | -12.0 | -18.7 |
S.E.⁺ | 6.6 | 5.7 | 10.5 | 11.9 |

⁺Control = no treatment for horn flies or GI nematode; HF = treated for horn flies; GN = treated for GI nematodes in late-May, mid-July and late-August; HF-GN = treated for both horn flies and GI nematodes.

Table 2. Calf growth performance - Trial 2.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Initial weight, lb</th>
<th>Late-May to mid-July gain, lb</th>
<th>Mid-July to weaning gain, lb</th>
<th>Total gain, lb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>310</td>
<td>91</td>
<td>134</td>
<td>225</td>
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<tr>
<td>Horn fly (HF)</td>
<td>309</td>
<td>97</td>
<td>147</td>
<td>244</td>
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<td>GI nematode (GN)</td>
<td>321</td>
<td>97</td>
<td>143</td>
<td>240</td>
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<tr>
<td>HF-GN</td>
<td>316</td>
<td>93</td>
<td>158</td>
<td>251</td>
</tr>
<tr>
<td>S.E.⁺</td>
<td>5.2</td>
<td>5.3</td>
<td>6.4</td>
<td>5.9</td>
</tr>
</tbody>
</table>

Contrasts

Control vs. HF | 0.5 | -6.5 | -12.6 | -19.1* |
Control vs. GN | -11.3 | -6.0 | -9.3 | -15.3† |
Control vs. HF-GN | -6.1 | -2.4 | -24.0* | -26.4* |
S.E.⁺ | 6.0 | 7.3 | 8.7 | 7.5 |

⁺Control = no treatment for horn flies or GI nematode; HF = treated for horn flies; GN = treated for flies and GI nematodes in late-May, mid-July and late-August; HF-GN = treated for both horn flies and GI nematodes.

⁺Average standard error of the treatment means or contrasts.

†P < 0.10; *P < 0.05.