Stocker Steer Gains and Fly Numbers as Impacted by Burn Date and Type of Mineral on Tallgrass Native Range – Year 5

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Stocker Steer Gains and Fly Numbers as Impacted by Burn Date and Type of Mineral on Tallgrass Native Range – Year 5

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Summary
This study aims to evaluate effectiveness of two operational management systems for steer gains and fly control. The first strategy evaluated was pasture burn date of March (MAR) or April (APR). The second management strategy was free-choice mineral with spices (SPICE) or without spices (CON). Eight pastures (n = 281 steers; initial weight 566 lb) were used in a 2 × 2 factorial treatment structure. Steers were weighed individually, randomly assigned to treatment, and grazed for 89 days. Weekly, 33% of steers were photographed to count flies and evaluated for hair coat score. Steers that grazed pastures that were burned in March had a greater average daily gain than those grazing pastures that were burned in April and March resulted in nearly 30 pounds more gain per calf during the grazing season. Steers that consumed the mineral that contained the spices/essential oils had a 0.10 pound per day advantage as compared to steers on the control mineral. There was an interaction between pasture burn date and mineral type where steers gained the most on March burned pastures (with no difference in mineral type), had the second greatest gains on the April burned pastures with SPICE mineral, and had the lowest gains on the April burned pastures with CON mineral. Weather plays a very important role in cattle performance following a complete pasture burn, and in a year with excessive spring moisture and extreme drought beginning in June, a March burn was the better management practice.

Introduction
Essential oils/spices have been offered as a potential method to control insects in cattle (Showler, 2017; Massariol et al., 2009), alter rumen microbial population (Elcoso et al., 2019), and replace feed antibiotics, all of which may improve production responses in beef as well as dairy cattle. In feedlot studies, cattle consuming a blend of essential oils had similar average daily gain, final body weight, gain to feed ratios, and carcass characteristics as steers fed monensin with or without tylosin (Araujo et al., 2019). Grazing stocker cattle on cool-season annual grass pasture or summer pasture did not show improvements in gains when cattle received a cinnamon and garlic essential oil product by either free-choice or hand-feeding (Beck et al., 2017). However, other studies at Kansas State University have found that feeding supplements of spices in mineral have increased gain in growing cattle on grass (Farney, 2020a; Farney, 2020b).

1 Undergraduate intern, Department of Animal Science, College of Agriculture, Kansas State University.
Burning pasture in April resulted in about 20 pounds more gain in grazing cattle than burning a pasture in March (Owensby, 2010). Smoke management plans are important for the state of Kansas as high smoke production in April creates smoky conditions that drift to large metropolitan areas. If weight gains and plant population changes are not too different when burning in March instead of April, earlier burning could provide the opportunity to develop a smoke management plan that allows for an increased burning season to dilute smoke by burning some pastures across multiple months rather than primarily in one.

The overall objective of this study is to evaluate management practices that may impact stocker steer gains on a 90-day double-stocking grazing system in tallgrass native range. Specific objectives are to evaluate the time of burning, and the inclusion of spices in the mineral supplement, and to determine whether the effects of both treatments are additive.

**Experimental Procedures**

The study was conducted at the Bressner Research unit in Yates Center, KS. The unit consists of eight pastures on 625 acres of tallgrass native prairie. Two management strategies were evaluated to determine effects on stocker steer gains in a $2 \times 2$ factorial arrangement. The two management strategies were timing of pasture burning and free-choice mineral supplementation. Within each management strategy there were two treatments being evaluated, thus a total of four treatments were applied to the cattle at the unit. The pasture burning management strategies evaluated were burning in March or burning in April. The pastures for the March burn treatment were burned on March 14, 2022, while the April burned pastures were burned on April 12, 2022.

The free-choice mineral supplementation strategies consisted of two treatments: (1) free-choice complete mineral (CON) where 25% of magnesium (Nuplex Mg/K, Nutech Biosciences, Inc., Oneida, NY), copper, zinc, and manganese came from chelated organic sources (Nuplex Chelate-3 blend, Nutech Biosciences); and (2) the same base mineral with the addition of spices (SPICE). The spices included were powdered forms of oils from garlic and the product Solace (proprietary blend of four spices; Wildcat Feeds Inc., Topeka, KS). The mineral analysis is listed in Table 1. The minerals were formulated for a 4 ounce/head/day intake and were offered free choice. Every week, 125% of that week’s formulated mineral consumption for each pasture was placed into feeders and weighed. Any remaining mineral from the previous week was also weighed.

**Gain Measures**

Two hundred eighty-one steers (average initial weight 566 lb) were weighed individually on April 24, 2022, and assigned to pasture randomly based on order through the chute. Cattle were weighed at the end of the study on July 24, 2022, for a total of 90 days of grazing. Data collected included initial and final weights, and then average daily gain and total gain were calculated.
**Fly Counts and Hair Coat Score**
Weekly, 33% of the steers in each pasture were photographed with a Nikon digital camera with a 300 mm zoom lens, with the photographer’s back to the sun. The steers were photographed with their entire side filling the viewfinder. Then photos were processed with ImageJ and flies counted. Additionally, hair coat score was recorded from the photos with a score of 1–5, where a 1 was a 100% slick haired animal; 2 had 25% of body with long hair; 3 has 50% of body covered in long hair; 4 has 75% of body covered in long hair; and 5 is 100% long haired. Data collected included number of flies and hair coat scores for each week.

**Results and Discussion**

**Performance of Steers**
Steers that were on March burned pastures gained on average 0.14 more pounds per day (ADG), which resulted in around 12 pounds more total gain per steer over the 90-day grazing period than those that were on April burned pastures ($P = 0.04$; Table 2). Steers that were consuming the spice mineral had a 0.13 pound/day increase in ADG, which resulted in, on average 12 pounds more weight at the end of the grazing period ($P = 0.04$; Table 2). There was an interaction ($P = 0.03$) between burn date and mineral where the steers that were grazed on March burned pastures regardless of mineral type, and April burned pastures with steers consuming spice mineral had a greater gain than steers that grazed April burned pastures where steers were on a control mineral, with no difference in gain based on mineral type (Table 2).

The spice mineral, averaged over the 5 years, has resulted in 0.10 pounds increase in ADG ($P = 0.003$) and that has been fairly consistent (2021 was the exception). Each of the 5 years of this study have had drastically different weather patterns, and weather seems to drive the most substantial differences in gains for 90-day stocker calves. Over the 5 years of the study, gains for the steers have not been different based on burn dates ($P = 0.75$), but within year gains have shown differences that were driven by weather events (Farney et al., 2020; Farney and Reeb, 2021; Farney et al., 2022; Farney et al., 2023).

**Fly Counts**
Flies increased through the summer ($P < 0.001$). There were no differences in fly numbers based on whether cattle consumed the mineral or based on pasture burn date ($P > 0.10$; Table 2). There were some interactions of week by mineral and week by burn date that were detected based on $P < 0.01$. During the first 4 weeks the steers were on pasture, those grazing March burned pastures had greater fly numbers than those on April burned pastures (Figure 1). At weeks 5 and 11 on pasture, April burned pastures had steers with more flies on them. This makes sense when looking at the life cycle of flies in relation to burning. When pastures are burned, that set of fly larvae are destroyed and it takes time for new flies to become introduced. With this set of data, about a month seems to be necessary for flies to become active after burning. The time from turnout date to March burn date was about 6 weeks, whereas there were only two weeks between turnout and the April burn date. For mineral type and fly numbers, contrary to the hypothesis, there were greater number of flies on steers that were consuming the spice mineral as compared to control, especially later in the
season (specifically weeks 6, 8, 12; Figure 2). Hair coat scores were not different for any measures ($P > 0.10$, Table 2).

**Conclusions**
Weather plays a large role in how stocker steers will gain weight following a pasture fire. With early precipitation before a drought in the middle of a grazing period, a March burn seems to result in greater stocker steer gains than an April burn. Addition of spices/essential oils in a free-choice mineral increases average daily gain by $\sim 0.1$ pounds per day, and that has been repeatable, regardless of pasture conditions.

**References**


Holstein cows fed with different garlic (*Allium sativum* L.) levels. Revista Brasileira de Plantas Medicinais. 11:37-42.


*Brand names appearing in this publication are for product identification purposes only. No endorsement is intended, nor is criticism implied of similar products not mentioned. Persons using such products assume responsibility for their use in accordance with current label directions of the manufacturer.*

Table 1. Analysis of minerals

<table>
<thead>
<tr>
<th>Item (on dry matter basis)</th>
<th>Control mineral</th>
<th>Spice mineral¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crude protein, %</td>
<td>5.69</td>
<td>5.50</td>
</tr>
<tr>
<td>Calcium, %</td>
<td>16.67</td>
<td>16.17</td>
</tr>
<tr>
<td>Phosphorus, %</td>
<td>3.33</td>
<td>3.44</td>
</tr>
<tr>
<td>Salt, %</td>
<td>22.54</td>
<td>22.53</td>
</tr>
<tr>
<td>Magnesium, %²</td>
<td>2.51</td>
<td>2.48</td>
</tr>
<tr>
<td>Potassium, %</td>
<td>0.89</td>
<td>0.88</td>
</tr>
<tr>
<td>Iron, ppm</td>
<td>5,546</td>
<td>5,529</td>
</tr>
<tr>
<td>Copper, ppm³</td>
<td>1,153</td>
<td>1,153</td>
</tr>
<tr>
<td>Zinc, ppm³</td>
<td>3,471</td>
<td>3,471</td>
</tr>
<tr>
<td>Manganese, ppm³</td>
<td>1,817</td>
<td>1,818</td>
</tr>
<tr>
<td>Selenium, ppm</td>
<td>22</td>
<td>22</td>
</tr>
<tr>
<td>Iodine, ppm</td>
<td>333</td>
<td>333</td>
</tr>
<tr>
<td>Cobalt, ppm</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>Vitamin A, IU</td>
<td>141,667</td>
<td>141,667</td>
</tr>
<tr>
<td>Vitamin D, IU</td>
<td>14,167</td>
<td>14,167</td>
</tr>
<tr>
<td>Vitamin E, IU</td>
<td>172</td>
<td>172</td>
</tr>
</tbody>
</table>

¹Spice mineral with similar base as control mineral with the addition of 3 pounds per ton of garlic oil and 18 pounds per ton of Solace (proprietary spice blend; Wildcat Feeds Inc., Topeka, KS) that replaced dried distillers grains and limestone in control mineral.

²Nuplex Mg/K (Nutech Biosciences Inc., Oneida, NY) contributed 25% of the magnesium in the minerals.

³Nuplex 3-chelate blend (Nutech Biosciences Inc., Oneida, NY) contributed 25% of the copper, zinc, and manganese of the total trace mineral supplied in the minerals.
Table 2. Performance measures and fly counts based on mineral and burn dates

<table>
<thead>
<tr>
<th>Item</th>
<th>March</th>
<th>April</th>
<th>P-value</th>
<th>Burn</th>
<th>Mineral</th>
<th>Burn × mineral</th>
</tr>
</thead>
<tbody>
<tr>
<td>In wt., lb</td>
<td>618</td>
<td>619</td>
<td></td>
<td>0.85</td>
<td>0.97</td>
<td>0.87</td>
</tr>
<tr>
<td>Out wt., lb</td>
<td>822</td>
<td>820</td>
<td></td>
<td>0.13</td>
<td>0.19</td>
<td>0.16</td>
</tr>
<tr>
<td>Gain, lb</td>
<td>204&lt;sup&gt;a&lt;/sup&gt;</td>
<td>202&lt;sup&gt;a&lt;/sup&gt;</td>
<td>178&lt;sup&gt;b&lt;/sup&gt;</td>
<td>204&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.3</td>
<td>0.05</td>
</tr>
<tr>
<td>ADG, lb/d</td>
<td>2.37&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.34&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.07&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2.37&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.04</td>
<td>0.05</td>
</tr>
<tr>
<td>Fly counts, n</td>
<td>51</td>
<td>59</td>
<td></td>
<td>0.52</td>
<td>0.93</td>
<td>0.11</td>
</tr>
<tr>
<td>Hair coat score</td>
<td>2.77</td>
<td>2.85</td>
<td>2.96</td>
<td>2.86</td>
<td>0.09</td>
<td>0.32</td>
</tr>
</tbody>
</table>

SEM = standard error of the mean.

Figure 1. Average number of flies per steer per week by pasture burn date.
Average number of flies per steer per week based on burning in March or in April (\(P < 0.01\)) are represented in the line chart.
March: March 15, 2022 was burn date represented by the solid green line with square markers.
April: April 19, 2022 was burn date represented by dashed black line with triangle markers.
* Indicates difference \(P < 0.05\) for that week between treatments.
** Indicates difference \(0.05 < P < 0.10\) for that week between treatments.
Figure 2: Average number of flies per steer per week by mineral treatments.

Average number of flies per steer per week \((P < 0.01)\) are represented in the line chart.

CON: control mineral is represented by the solid brown line with circle markers.

SPICE: spice mineral is the same base mineral as control with 3 pounds/ton of garlic oil and 18 pounds/ton of Solace (proprietary spice blend; Wildcat Feeds LLC).

* Indicates difference \(P < 0.05\) for that week between treatments.

** Indicates difference \(0.05 < P < 0.10\) for that week between treatments.