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Stocker Steer Gains and Fly Numbers as Impacted by Burn Date and Type of Mineral on Tallgrass Native Range – Year 4

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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 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 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 Control 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).

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Burning pasture in April results 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 would provide the opportunity to develop a smoke management plan that allows for an increased burning season to dilute a single month's smoke.

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 × 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 15, 2022, while the April burned pastures were burned on April 19, 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 21, 2022, and assigned to pasture randomly based on order through the chute. Cattle were weighed at the end of the study on July 20, 2022, for a total of 89 days of grazing. Five steers were in the wrong pasture at some point during the study and thus their data were not used so 276 were used in analysis. 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 were 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 had 50% of body covered in long hair; 4 had 75% of body covered in long hair; and 5 was 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 0.35 more pounds per day (ADG) which resulted in around 30 pounds more total gain per steer over the 90-day grazing period than those that were on April burned pastures ($P < 0.001$; Table 2). There was a tendency ($P = 0.09$) for steers that were consuming the spice mineral to have a 0.09 pound/day increase in ADG, which resulted in, on average, 8 pounds more weight at the end of the grazing period (Table 2). There was an interaction between burn date and mineral where the steers that were on March burned pastures had a greater gain than cattle that grazed April burned pastures, with no difference in gain based on mineral type. For the April burned pastures, the steers on the SPICE mineral had a greater gain than those of the CON mineral (Table 2).

The spice mineral, averaged over the 4 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 4 years of this study have had drastically different weather patterns, and that seems to drive the most substantial differences in gains for 90-day stocker calves. At the Yates Center location, in 2022 there was above average precipitation until June, then very little to no precipitation through the remainder of the growing season. Visually, the March burned pastures had a greater biomass in the early portion of the grazing season as compared to the April burn, and that may have been the reason for the increased gains observed with the March burn. Biomass samples were collected, but not yet analyzed to determine the differences in biomass production and forage quality during the growing season of 2022. Over the 4 years of the study, gains for the steers have not been different based on burn dates ($P = 0.33$). Within years, differences were driven by weather events (Farney et al., 2020b; Farney and Reeb, 2021; Farney and Frahm, 2022).

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 × burn date that were detected based on $P < 0.01$. Differences in fly numbers were driven by the much greater fly population in the later part of the summer as compared to the earlier part of the grazing season. No individual weeks showed a difference in fly populations based on either mineral consumed or burn date (Figures 1 and 2). Hair coat scores were not different for any measures ($P > 0.10$, Table 2).

Conclusions

Weather plays a large role in how stocker steer gains will occur 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 ~0.1 pounds per day, and that has been repeatable, regardless of pasture conditions.

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Table 1. Analysis of minerals

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

[1]Spice mineral with similar base as control mineral with the addition of 3 pounds per ton garlic oil and 18 pounds per ton of Solace (Wildcat Feeds Inc., Topeka, KS) that replaced dried distillers grains and limestone in control mineral.
[2]Nuplex Mg/K (Nutech Biosciences Inc., Oneida, NY) contributed 25% of the magnesium in the minerals.
[3]Nuplex 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

	March		April			*P*-value		
Item	Control	Spice	Control	Spice	SEM	Burn	Mineral	Burn × mineral
In wt., lb	566	567	565	566	8.9	0.92	0.92	0.95
Out wt., lb	813	812	772	790	10.1	0.001	0.42	0.36
Gain, lb	248[a]	244[a]	207[c]	225[b]	4.0	<0.001	0.09	0.01
ADG, lb/d	2.76[a]	2.71[a]	2.30[c]	2.50[b]	0.04	<0.001	0.09	0.01
Fly counts, n	46	62	39	40	1.16	0.13	0.34	0.45
Score coat score	1.9	1.8	1.9	1.9	0.10	0.95	0.36	0.92

SEM = standard error of the mean.

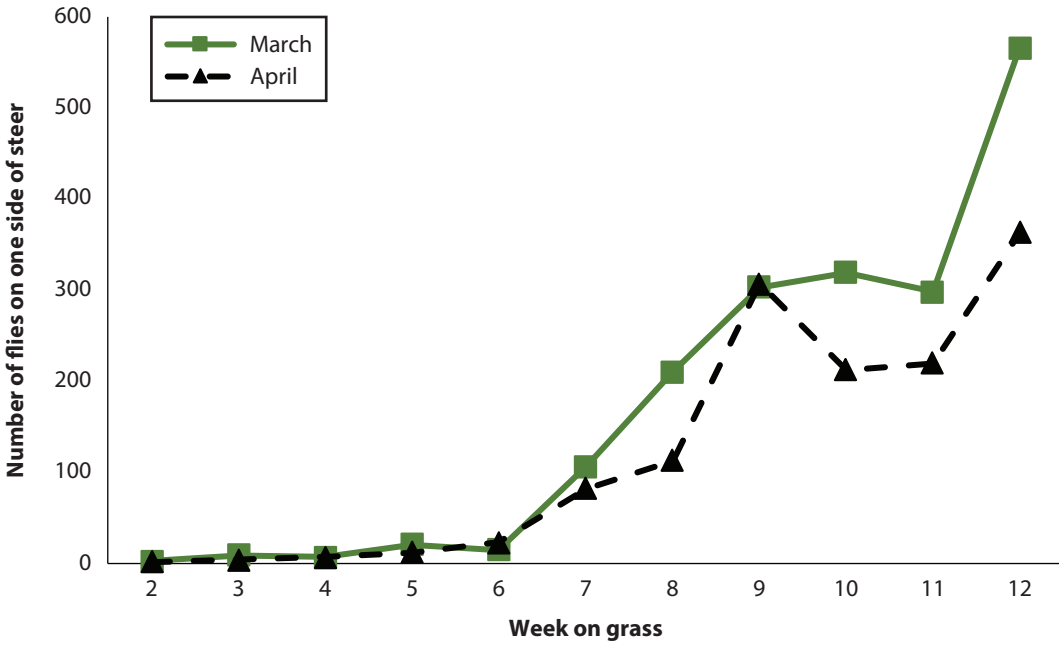

Figure 1. Average number of flies per steer per week by pasture burn date.
Average number of flies per steer per week ($P < 0.01$) are represented in the line chart.
March burn date: March 15, 2022. Line is represented by the solid green line with square markers.
April burn date: April 19, 2022. Line is represented by dashed black line with triangle markers.

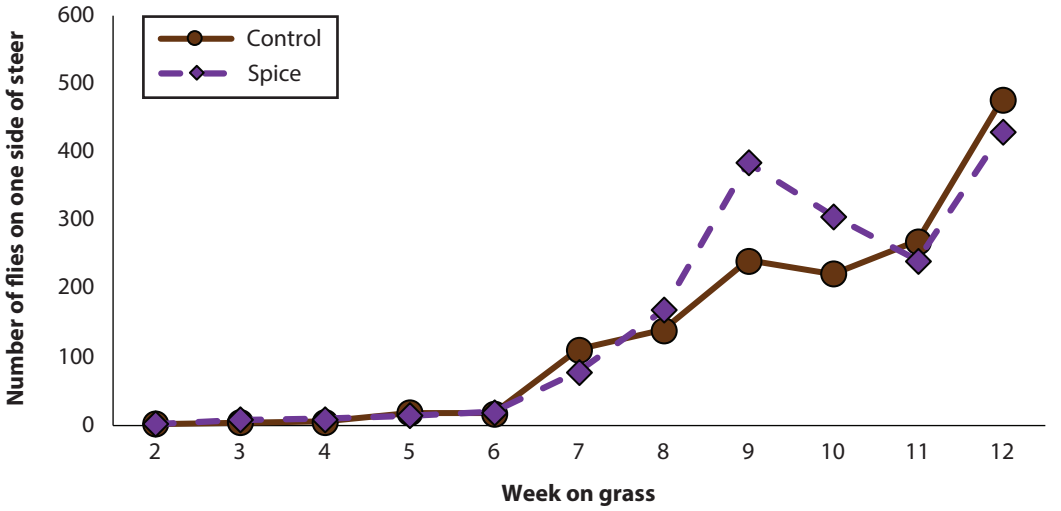

Figure 2. Average number of flies per steer per week by mineral treatments.
Average number of flies per steer per week ($P < 0.01$) are represented in the line chart.
CON: control mineral is represented by the solid brown line with circle markers.
SPICE: spice mineral is the same base mineral as control with 3 pounds/ton of garlic oil and 18 pounds/ton of Solus (Wildcat Feeds LLC). Represented by the purple line with diamond markers.