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Effects of a blended garlic and cinnamon essential oil extract with and without monensin sodium on the performance of grazing steers[1]

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ABSTRACT

A series of stocker grazing experiments was conducted with the objective to determine the efficacy of supplementing growing calf diets with essential oils from garlic and cinnamon extracts (GCOE) in promoting growth on cool-season annual grasses in Arkansas (SWREC) and Oklahoma (SPER), or native rangeland at SPER. At the SWREC, steers (n = 272, BW ± SE = 209 ± 7.8 kg) grazing cool-season annual pastures were hand fed supplements containing mineral premixes that (1) were nonmedicated, (2) provided 250 mg/d of GCOE (NextEnhance, Novus International, St. Louis, MO), (3) provided 200 mg/d of monensin (MON, Rumensin, Elanco Animal Health, Indianapolis, IN), or (4) provided both 250 mg/d of GCOE and 200 mg/d of MON. In the SWREC experiment, there were no differences ($P \geq 0.13$) in either BW or ADG due to GCOE, MON, or their interactions. At the SPER, steers grazing wheat pasture (n = 72, BW ± SE = 250 ± 3.9 kg) were offered ad libitum access to mineral supplements that were nonmedicated or contained 1.6 g of GCOE/kg mineral, and steers and heifers (n = 132, BW ± SE = 249 ± 4.7 kg) grazing summer native rangeland were offered ad libitum access to mineral supplements that (1) were nonmedicated; (2) provided 2.4 g of GCOE/kg; (3) provided 1.8 g of MON/kg, or (4) provided 1.8 g of MON and 2.4 g of GCOE/kg. At the SPER, there were no differences ($P \geq 0.12$) in either BW or ADG due to GCOE, MON, or their interactions. In these experiments, providing GCOE or MON either by hand feeding or in self-fed mineral supplements had no effect ($P \geq 0.12$) on ADG or BW of growing calves grazing cool-season annual grass pasture or summer native rangeland.

Key words: grazing, growing steer, performance, plant extract

INTRODUCTION

Growth promoting technologies can increase the profitability of the stocker cattle enterprise (Beck et al., 2014a) while improving the environmental sustainability of beef production (Capper and Hayes, 2012). Monensin has been shown to increase the ADG of grazing calves by 0.07 to 0.20 kg/d (Oliver, 1975; Potter et al., 1976; Horn et al., 1981; Fieser et al., 2007; Beck et al., 2014a). Essential oils from garlic or cinnamon extracts (**GCOE**) have been reported to alter the ruminal environment and improve ruminal fermentation by increasing the propionate-to-acetate ratio (Busquet et al., 2005; Wanapat et al., 2008), and decrease the ruminal degradability of feed proteins, such as those found in wheat forage (Busquet et al., 2005; Yang et al., 2010).

Mineral supplementation for cattle grazing wheat (*Triticum aestivum* L.) pasture or native rangeland can significantly affect the net return to the producer by increasing ADG (Horn et al., 2005; Gunter and Combs, 2010). The mineral composition of wheat forage indicates that it provides inadequate Ca for cattle (Stewart et al., 1981; Grunes et al., 1984). With cattle grazing sand sagebrush rangeland (Berg, 1994) in the southern Great Plains, research has shown that forages on these range types are adequate in P and Ca (Savage and Heller, 1947), unlike re-

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sults from tallgrass prairie (Glendening et al., 1952; Umoh et al., 1982). Free-choice minerals are commonly used as supplements for grazing cattle, but these minerals can also be included in hand-fed energy and protein supplements. Minerals or hand-fed supplements can be used as carriers to provide substances, such as monensin, GCOE, or both, to grazing livestock. Hence, the objective of these experiments was to determine the efficacy of supplementing grazing calves with essential oils from GCOE in promoting additional growth on cool-season annual pasture in southern Arkansas and northwest Oklahoma, or on native sand sagebrush rangelands in northwest Oklahoma.

MATERIALS AND METHODS

Animal procedures in the experiments conducted at the University of Arkansas Southwest Research and Extension Center (**SWREC**) were approved by the University of Arkansas Institutional Animal Care and Use Committee (Protocol #12042). Animal procedures in the experiments conducted at the Southern Plains Experimental Range (**SPER**) managed by the USDA, ARS, Southern Plains Range Research Station were approved by the Southern Plains Range Research Station Animal Care and Use Committee.

University of Arkansas SWREC

Study Site. This research was conducted in Arkansas at the facilities of the SWREC Stocker Unit near Perrytown, Ardansas (33°42′N, 93°31′W, elevation 109 m) over 3 cool-season annual pasture grazing seasons (spring 2012, fall and winter 2012–2013, and spring 2013). Soils in these pastures are primarily Smithdale fine sandy loam but also include areas of Sawyer loam, which are deep, moderately well drained, and low in native fertility, with low soil pH and OM. Pastures, the permanent base of which are a mixture of warm-season grasses including bermudagrass [*Cynodon dactylon* (L.) Pers.], crabgrass [*Digitaria sanguinalis* (L.) Scop.], and dallisgrass (*Paspalum dilatatum* Poir.) with some pastures containing varying percentage stands (5 to 10%) of tall fescue (*Festuca arundinacea* Schreb.), were interseeded via a no-till drill with a mixture of small grains and annual ryegrass (*Lolium multiflorum* Lam.) in mid-September to early October of each year. Pastures were also fertilized with 55 kg/ha of N as ammonium nitrate in the fall and spring of each year. Before planting, these mixed bermudagrass–crabgrass pastures were grazed to a 5-cm stubble height and then cool-season annual grasses were interseeded in 17-cm rows to a depth of 1 cm via a no-till drill (Great Plains 1006NT, Salina, KS). The pastures were planted with mixtures of either oats (*Avena sterilis* L. 'Bob,' 134 kg/ha) and annual ryegrass ('Marshall,' 28 kg/ha) or cereal rye [*Secale cereale* L. 'Elbon' (fall 2011) and 'Wintergrazer70' (fall 2012), 134 kg/ha] and annual ryegrass ('Marshall,' 28 kg/ha).

During the spring 2012 grazing season, 28 pastures (0.8 ha each) of mixed oat–ryegrass or cereal rye–ryegrass were grazed by growing steers (n = 112) from early March to mid-May (84-d grazing period; n = 7 pastures per treatment). Treatments were allocated to pastures so that cool-season species and pasture forage production potential was equally represented for each treatment. During the fall and winter 2012 to 2013 grazing season, twenty 1.6-ha mixed cereal rye–ryegrass pastures were grazed by growing steers (n = 80) from mid-November to mid-February (90-d grazing period; n = 5 pastures per treatment). During the spring of 2013, steers (n = 80) grazed twenty 0.8-ha cereal rye–ryegrass pastures from late February to late April (63-d grazing period; n = 5 pastures per treatment).

Treatments and Animals. Steers in this series of experiments were supplemented daily with 1.02 kg of a nonmedicated supplement (88% soybean hulls and 12% mineral premix, as-fed basis) and provided 250 mg/d of a mixture of garlic and GCOE (NextEnhance, Novus International, St. Louis, MO), 200 mg/d of monensin (**MON**, Rumensin, Elanco Animal Health, Indianapolis, IN), or both 250 mg/d of GCOE and 200 mg/d of MON.

Preconditioned steer calves (n = 112 in spring 2012, BW = 216 ± 4.8; n = 80 in the fall and winter of 2012 and 2013, BW ± SE = 217 ± 6.7; and n = 80 in spring 2013, BW ± SE = 194 ± 3.7) were allocated to groups to equalize BW, and these groups were then randomly assigned pastures that were assigned to the 4 treatments before initiation of each grazing period. Steers used in spring 2012 and spring 2013 were provided by a collaborator. These steers had been acquired from a local livestock auction and were USDA #1 or #2 muscling (USDA, 1979) with the majority of steers exhibiting predominantly English (Angus or Hereford) or Continental (Charolais, Gelbvieh, or Simmental) breeding. A minor percentage (<15%) of the steers exhibited a small percentage (≤37.5%) of *Bos indicus* or Longhorn breeding. Steers used in fall and winter of 2012 to 2013 were weaned from the University of Arkansas SWREC cowherd (n = 60) and were 87% or greater Angus breeding or were from the University of Arkansas Livestock and Forestry Branch Station (n = 20) and were 50% Charolais and 50% Balancer breeding. Beginning, ending, and interim BW were collected by weighing once in the morning following a 16-h removal from pasture and withdrawal of feed and water as recommended by the research of Aiken and Tabler (2004). Supplements were provided daily each morning, and any refusals were measured weekly.

Forage Sample Collection and Analysis. Forage mass, chemical composition, and species composition were measured monthly. Forage mass in each field was estimated monthly during the grazing season using a calibrated rising-plate meter with 20 sampling points per pasture (Michell and Large, 1983). Calibration samples were collected by clipping all forage within a single 0.1-m^2 frame in each pasture at each sampling to 2.5-cm stubble height with hand shears. Clipped calibration samples were dried to a constant weight under forced air at 60°C. Dry weights