Comparison of two organic trace mineral supplements for cows grazing tall-fescue
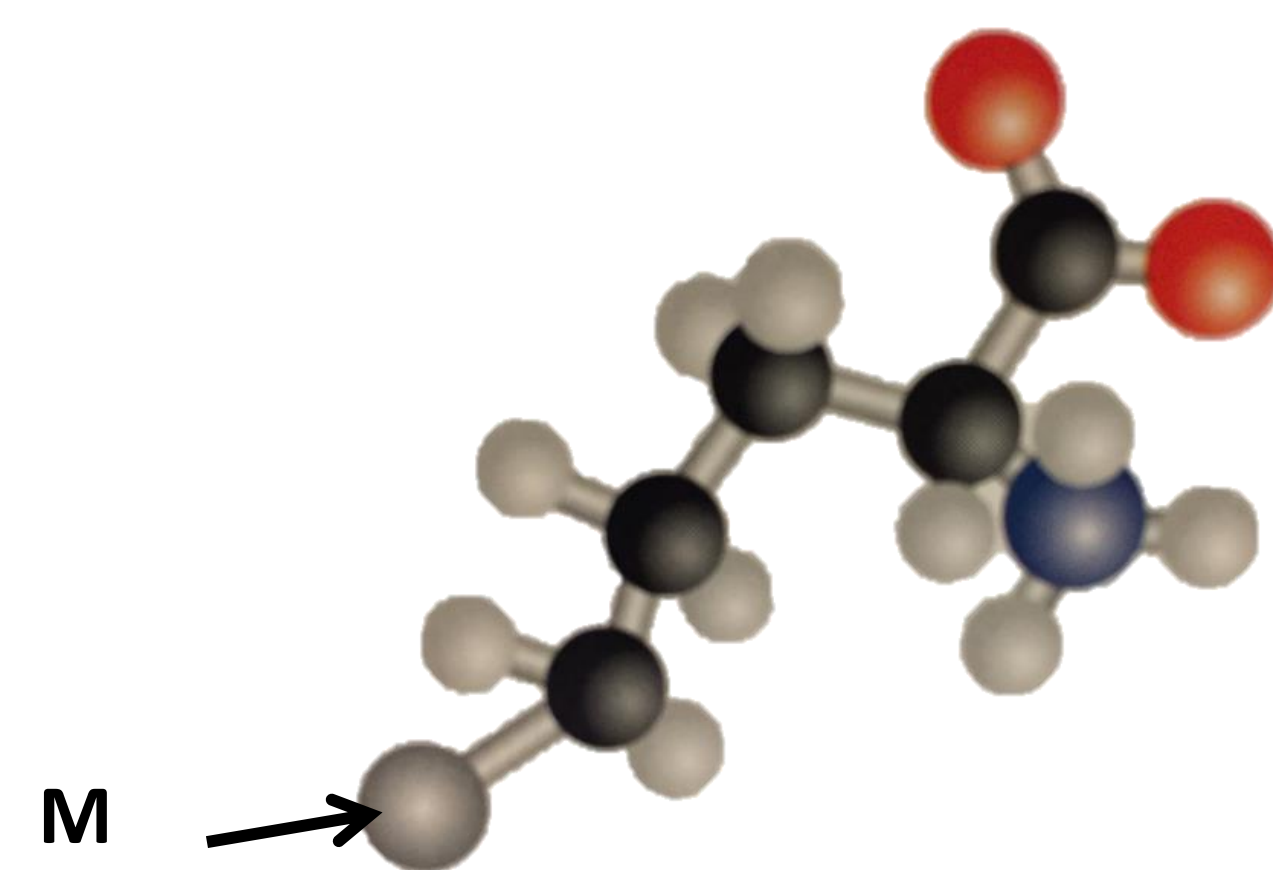
J. K. Farney

INTRODUCTION

- Failure to breed #1 culling criteria beef cattle (NAHMS, 2010)
- One of most difficult breeding system is spring-calving herds on endophyte-infected K31 tall fescue
  - Hot weather ↓ pregnancy rate
  - ↑ body temperature with endophyte toxin ↓ pregnancy rate
- Organic trace minerals can ↑ pregnancy rates especially to AI conception (Ahola et al., 2004)
- Overall, organic forms of minerals have been shown to ↑ pregnancy rates over feeding minerals from more readily available sources; however differences are seen across age groups, breeding methods, and time (Stanton et al., 2000; Ahola et al., 2004; Arthington and Swenson, 2004; Whitehurst et al., 2014).

METHODS

- Two treatments of free-choice mineral with trace minerals coming for organic sources
  - **COMP:** metal amino-acid complexes of the trace minerals Zn, Cu, and Mn with Mg source from magnesium oxide (MgO)
  - **CHEL:** metal amino-acid chelates of the trace minerals Zn, Cu, and Mn and magnesium amino acid chelate
- Four ranches in Southeast Kansas and Southwest Missouri participated in this study providing 203 head of spring-calving cows
- Mineral offered free choice in covered mineral feeders beginning 30 days before breeding season and ending at pregnancy check
- Blood samples taken before mineral supplied and at preg check
  Serum analyzed for Zn, Cu, Mn, and Mg
- Pregnancy rate and calving date with ranches respective calving season was recorded
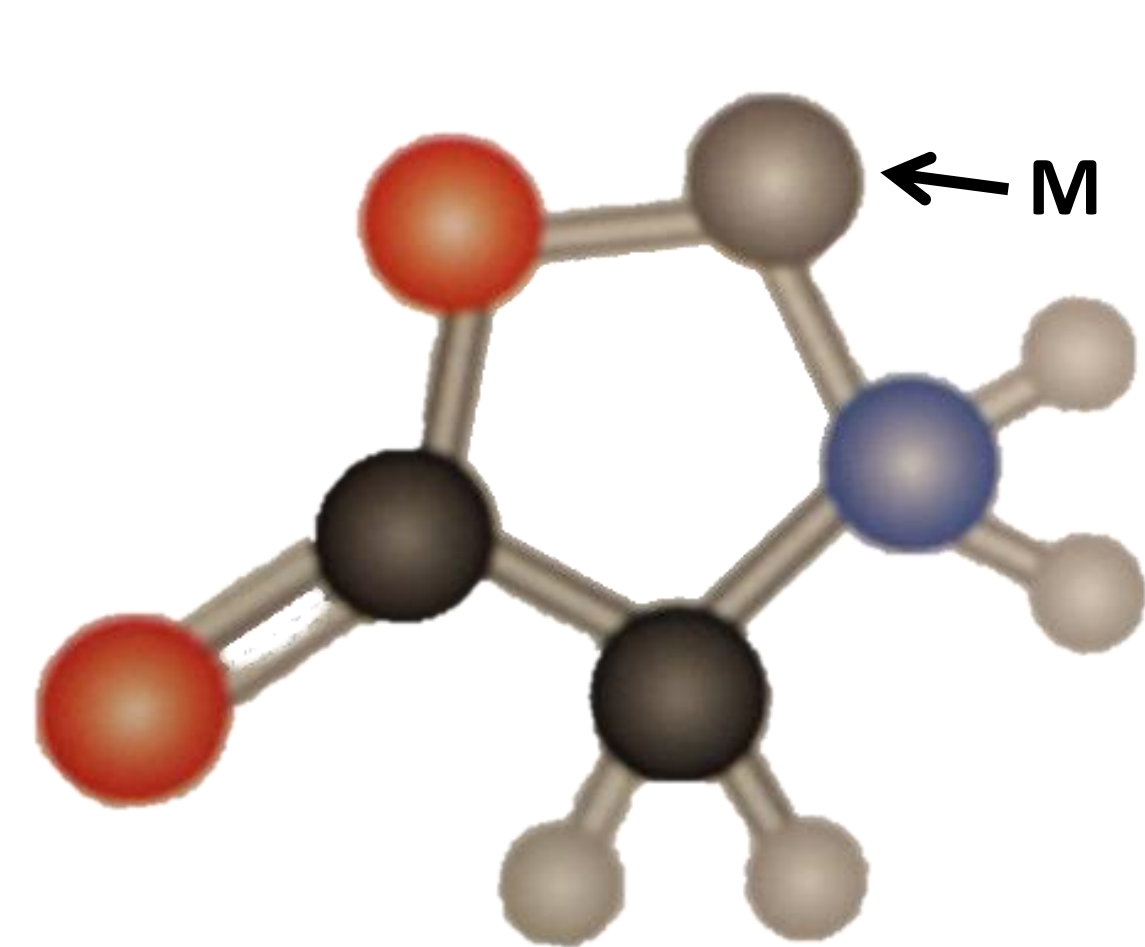
Chelate chemical structure   Complex chemical structure

Calculated nutrient analysis (DM basis)

Treatment	Ca (%)	P (%)	Salt (%)	Mg (%)	Cu (ppm)	Zn (ppm)	Mn (ppm)	Se (ppm)
CHEL	13.45	5.84	21.72	2.79	957.01	3527.5	1727.5	20.69
COMP	13.41	5.83	21.66	2.79	932.14	3517.6	1722.7	20.63

RESULTS

Pregnancy rates by treatment and ranch

Treatment	Ranch A	Ranch B	Ranch C	Ranch D	Total
CHEL % (n)	93.1 (49)	93.3[a] (15)	100 (14)	85.0 (20)	92.9 (98)
COMP % (n)	91.2 (50)	70.6[b] (17)	100 (16)	95.5 (22)	89.3 (105)
Ranch Preg rate% (n)	88.9 (99)	84.4 (32)	100 (30)	90.4 (42)	90.1 (203)

Pregnancy rates with Ranch D removed due to anaplasmosis event

Treatment	Ranch A	Ranch B	Ranch C	Ranch D	Total
CHEL % (n)	93.1 (49)	93.3[a] (15)	100 (14)	--	95.5 (78)
COMP % (n)	91.1 (50)	70.6[b] (17)	100 (16)	--	87.2 (83)
Ranch Preg rate (%)	92.1 (99)	82.0 (32)	100 (30)	--	91.6 (161)

[ab] Superscripts with different letters differ within column with $P < 0.05$.

Average calving date within ranches calving season

Treatment	Ranch A	Ranch B	Ranch C	Ranch D	Ave.
CHEL	27.8	31.9	27.9[b]	50.4	34.5[b]
COMP	27.7	30.2	13.8[a]	41.5	28.3[a]

Average calving date with Ranch D removed due to anaplasmosis event

Treatment	Ranch A	Ranch B	Ranch C	Ranch D	Ave.
CHEL	27.9	31.9	27.9[b]	--	29.2
COMP	27.9	30.2	13.9[a]	--	24.0

[ab] Superscripts are treatment differences within column with $P < 0.05$.

### Final serum mineral with recommended blood levels for production
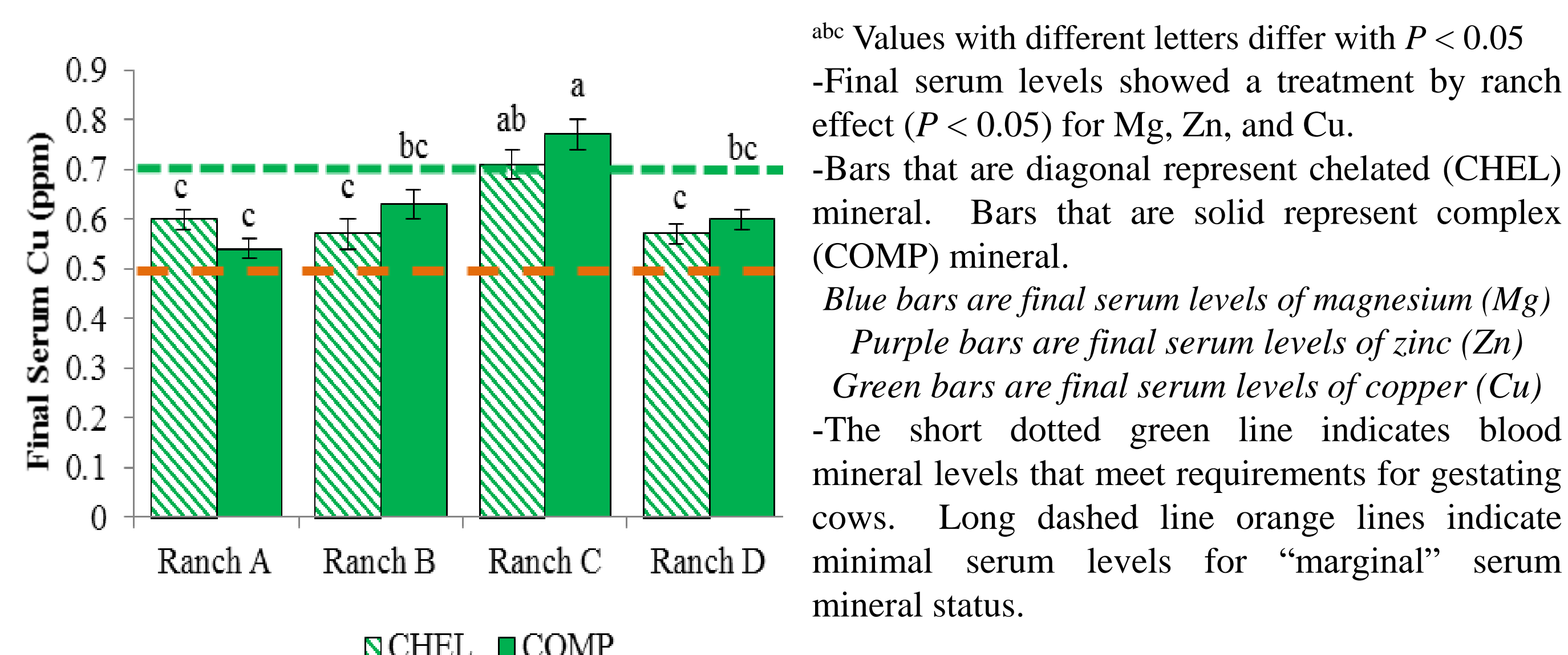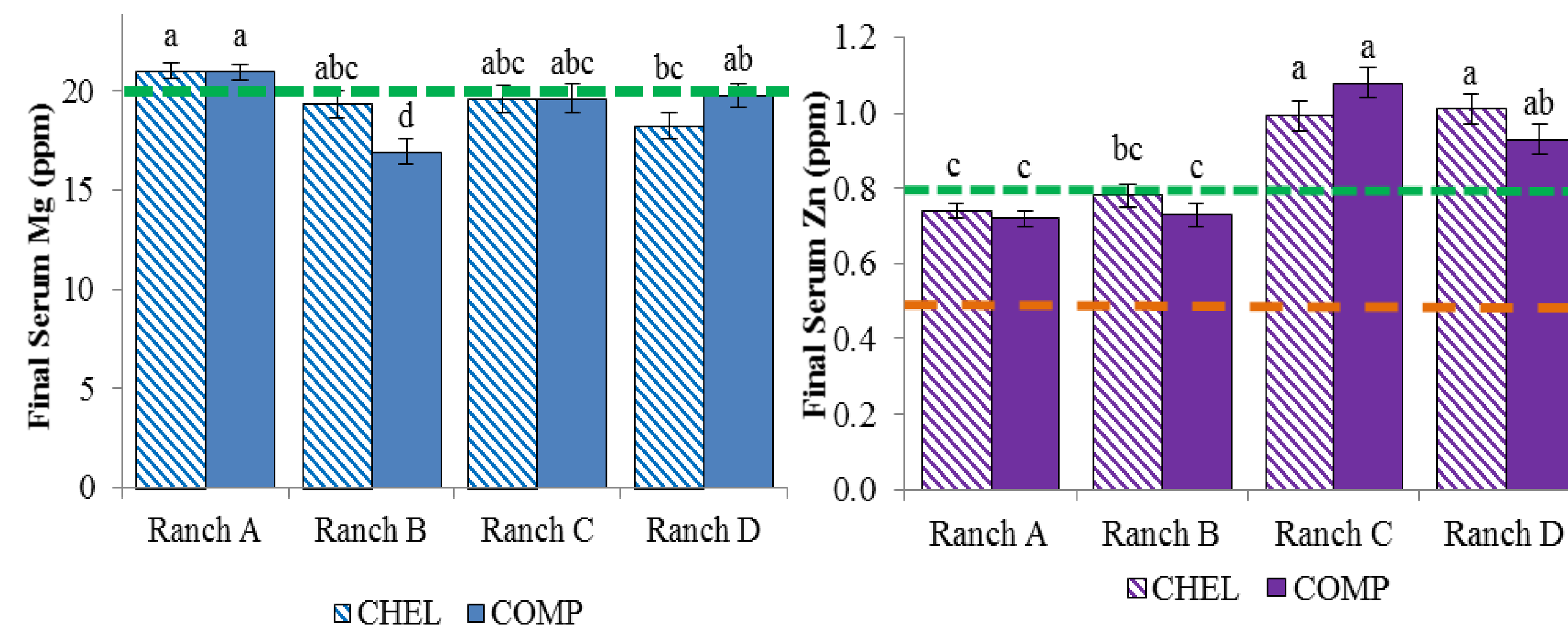
[abc] Values with different letters differ with $P < 0.05$
-Final serum levels showed a treatment by ranch effect ($P < 0.05$) for Mg, Zn, and Cu.
-Bars that are diagonal represent chelated (CHEL) mineral. Bars that are solid represent complex (COMP) mineral.
 Blue bars are final serum levels of magnesium (Mg)
 Purple bars are final serum levels of zinc (Zn)
 Green bars are final serum levels of copper (Cu)
-The short dotted green line indicates blood mineral levels that meet requirements for gestating cows. Long dashed line orange lines indicate minimal serum levels for "marginal" serum mineral status.

Serum difference (final minus initial) for all four minerals in ppm

Treatment	Mg	Zn	Cu	Mn
CHEL	-0.1	-0.16	-0.08	-0.001
COMP	-3.5	-0.10	0.05	0.0001
P-value	0.11	0.96	0.37	0.99

Serum mineral levels with average daily mineral intake
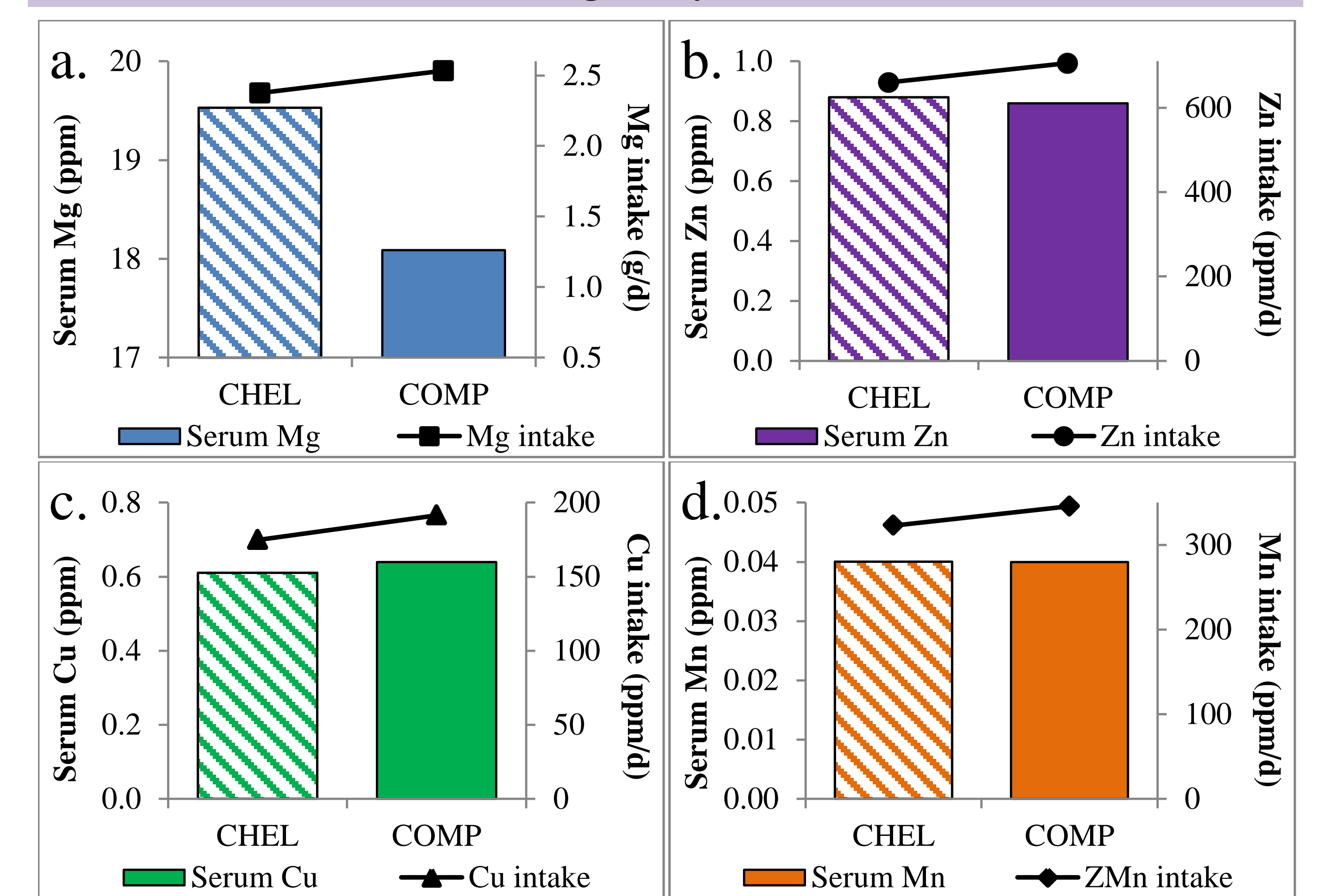
There is no difference ($P > 0.10$) in serum minerals by treatment. Daily mineral intakes were lower on CHEL mineral than COMP minerals. The combination of reduced intake and equal to or higher serum levels indicate that CHEL mineral is more bioavailable than COMP mineral for all for minerals measured in serum analysis (Mg, Cu, Zn, and Mn).
* CHEL minerals are recognized by diagonal lines within bar and COMP in solid bars.

IMPLICATIONS

- The amino acid chelated organic trace mineral supplement shows promise to aid in reproductive success for spring-calving producers on K31 endophyte infected fescue.
- Even though significance was not achieved in this study, economically there was a greater pregnancy rate for cows on chelated trace minerals.
- Magnesium plays a role in reproductive success as evidenced by this study. Cattle with higher circulating concentrations of Mg breed earlier (data not shown, but cows on COMP mineral had higher initial serum Mg); however, a static concentration appears to improve herd-level pregnancy rates, which was observed with the amino acid chelated mineral where initial and final serum Mg were the same.
- The chelated form of trace minerals are more bioavailable as evidenced by a lower intake while still having serum levels that are equal to or greater than the complex form.

ACKNOWLEDGMENTS