ACUTE ANAPLASMOSIS REDUCES BREEDING SOUNDNESS IN EXPERIMENTALLY INFECTED BEEF BULLS

PRESENTER:
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Introduction

- Bulls are vital to U.S. cow-calf herds and bull breeding soundness is essential for successful reproduction, genetics, and financial viability.
- *Anaplasma marginale*, a U.S. endemic tick-borne blood pathogen, causes fever, anemia lethargy and weight loss in clinical disease in cattle.
- Anemia, fever and weight loss generally reduce bull breeding soundness
- **Objective**: Determine if **acute clinical anaplasmosis** impacts bull **breeding soundness exam (BSE) pass rate**, including sperm motility and morphology and scrotal circumference during and upon resolution of clinical anaplasmosis.
- **Hypothesis**: Clinical signs associated with anaplasmosis will result in lower BSE pass rates.

Materials & Methods

- 3 uninfected control bulls; 3 bulls challenged with *A. marginale* – all 6 bulls *A. marginale* naïve, healthy and reproductively sound prior to study start
- Weekly BSEs performed (16 total BSEs performed)
- Packed cell volume (PCV) to monitor anemia and rectal temperature to monitor fever (1-3 times weekly)
- *A. marginale* bacteremia (qPCR) and seroconversion (cELISA) (1-3 times weekly)

Results

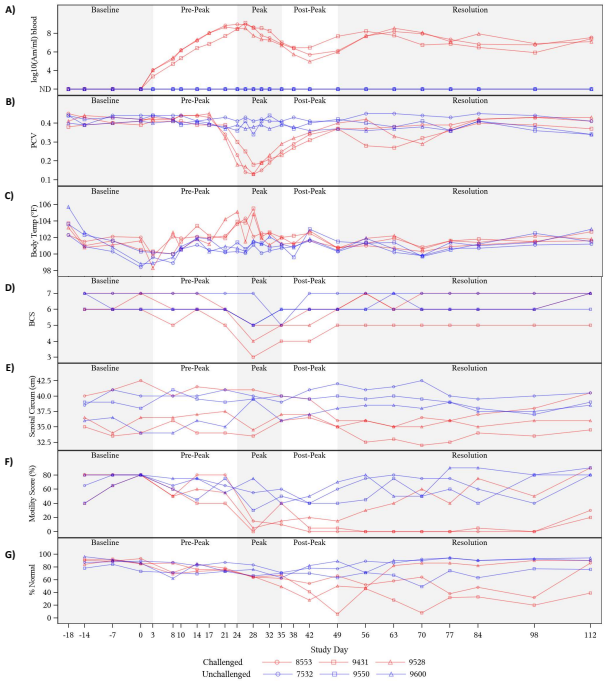
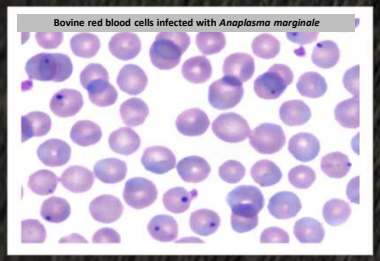


Figure 1. Changes in bacterial, clinical, and breeding soundness parameter throughout a course of clinical anaplasmosis. All data is plotted against a course of clinical anaplasmosis, including: baseline (pre-infection), pre-peak (incubation period), peak (expression of clinical signs), post-peak (period of improving clinical signs), and resolution (signs of clinical anaplasmosis fully resolved). Data presented: A) *Anaplasma marginale* bacteremia (*A. marginale*/mL blood); B) Packed cell volume (PCV); C) Body temperature (°F); D) Body condition score (standard 9-point scale); E) Scrotal circumference (cm); F) Sperm motility (% of sperm with progressive motility); and, G) Sperm morphology (% of sperm with normal morphology).

Clinical anaplasmosis in breeding beef bulls **reduces breeding soundness during** and **after** the course of clinical disease.



Relevance of Research to Kansas:

- Bovine anaplasmosis costs the U.S. cattle industry ~$300 million in losses per year
- In Kansas, beef cattle is the single largest agriculture sector ($6.3 billion direct output, 34,130 jobs)
- ~50% of Kansas beef cattle herds are actively infected with *A. marginale*
- ~94% of cows are bred by bulls, thus bull value is directly related to reproductive ability
- Impairment of bull reproductive abilities through death or disease has significant economic consequences for producers.

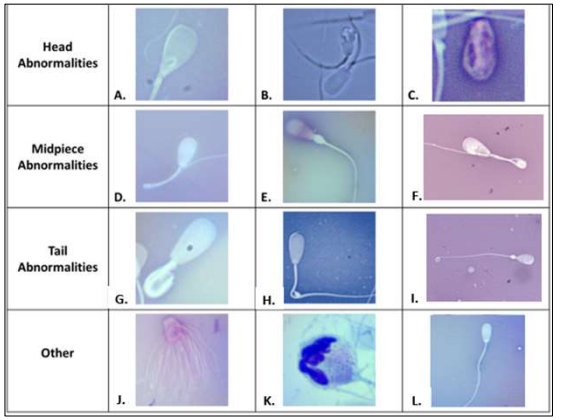


Figure 2. Sperm and other cells observed in semen of bulls infected with *A. marginale*. Head Abnormalities: A. Pyriform Head; B. Nuclear Vacuolation; C. Abnormal Free Head; Midpiece Abnormalities: D. Distal Midpiece Reflection (DMR); E. Proximal Droplet; F. DMR; Tail Abnormalities: G. Coiled tail; H. Bowed Midpiece; I. Distal coil with proximal droplet (midpiece); Other: J. Medusa cell; I. Spermatocyte (immature sperm cell); J. Normal, mature sperm cell

Table 1. Changes progressive sperm motility in bulls throughout a course of clinical anaplasmosis.

Anaplasmosis Disease Phase	Day Post-Infection	Treatment Group	% of sperm from *A. marginale* infected bulls with progressive motility	Mean progressive motility difference from uninfected control bulls	P value testing difference ≠ 0
Pre-Peak	8	Challenged	53%	-14%	0.053
		Unchallenged	67%	.	.
	14	Challenged	59%	-6%	0.721
		Unchallenged	66%	.	.
	21	Challenged	59%	-6%	0.706
		Unchallenged	65%	.	.
Peak	28	Challenged	6%	-49%	0.027
		Unchallenged	54%	.	.
Post-Peak	35	Challenged	22%	-29%	0.107
		Unchallenged	50%	.	.
	42	Challenged	9%	-34%	0.018
		Unchallenged	43%	.	.
Resolution	49	Challenged	6%	-51%	0.019
		Unchallenged	57%	.	.
	56	Challenged	10%	-57%	0.046
		Unchallenged	67%	.	.
	63	Challenged	15%	-52%	0.015
		Unchallenged	67%	.	.
	70	Challenged	21%	-36%	0.168
		Unchallenged	57%	.	.
	77	Challenged	14%	-61%	0.042
		Unchallenged	75%	.	.
	84	Challenged	28%	-35%	0.344
		Unchallenged	62%	.	.
	98	Challenged	18%	-47%	0.079
		Unchallenged	65%	.	.
	112	Challenged	49%	-33%	0.107
		Unchallenged	81%	.	.

Conclusions

- Clinical anaplasmosis reduces bull breeding soundness
- 100% *A. marginale*-challenged bulls developed acute anemia and fever, lost body condition, and did not pass BSE during peak anaplasmosis
- 100% *A. marginale*-challenged bulls experienced reductions in scrotal circumference, sperm motility and morphology

Future Studies

- Investigate the impact of *A. marginale* carrier status on BSE outcomes
- Repeat with a larger sample size to more fully analyze changes in BSE parameters.
- Evaluate the influence of signalment (i.e. age, breed)
- Evaluate testicular insult with imaging & biopsy

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