

Bull nutrition and management for a successful breeding season

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CAL POLY

Outline

- Bull Selection and Management Decisions
- Bull Nutritional Development Pre- and Post-Weaning
- Bull Management During Breeding Season

Bull Selection & Management

- Seedstock Producers:
 - Identify and sell the best genetics
 - Phenotypic vs. Genotypic selection
 - Contemporary groups
 - Successfully develop bulls pre- and post-weaning (nutritional management)
- Commercial Producers:
 - Purchase high-quality bulls with progressive genetics to fit specific goals
 - Investment
 - Fertility
 - Carcass quality
 - Maternal versus terminal traits

What do commercial producers want?

**Have you completed the
Bull Purchasing & Management Survey?**

Don't have a physical copy? Take the survey online!

Scan the QR code below with your phone camera or
visit ucanr.edu/bullsurvey



California Bull Selection and Management Survey

Objectives:

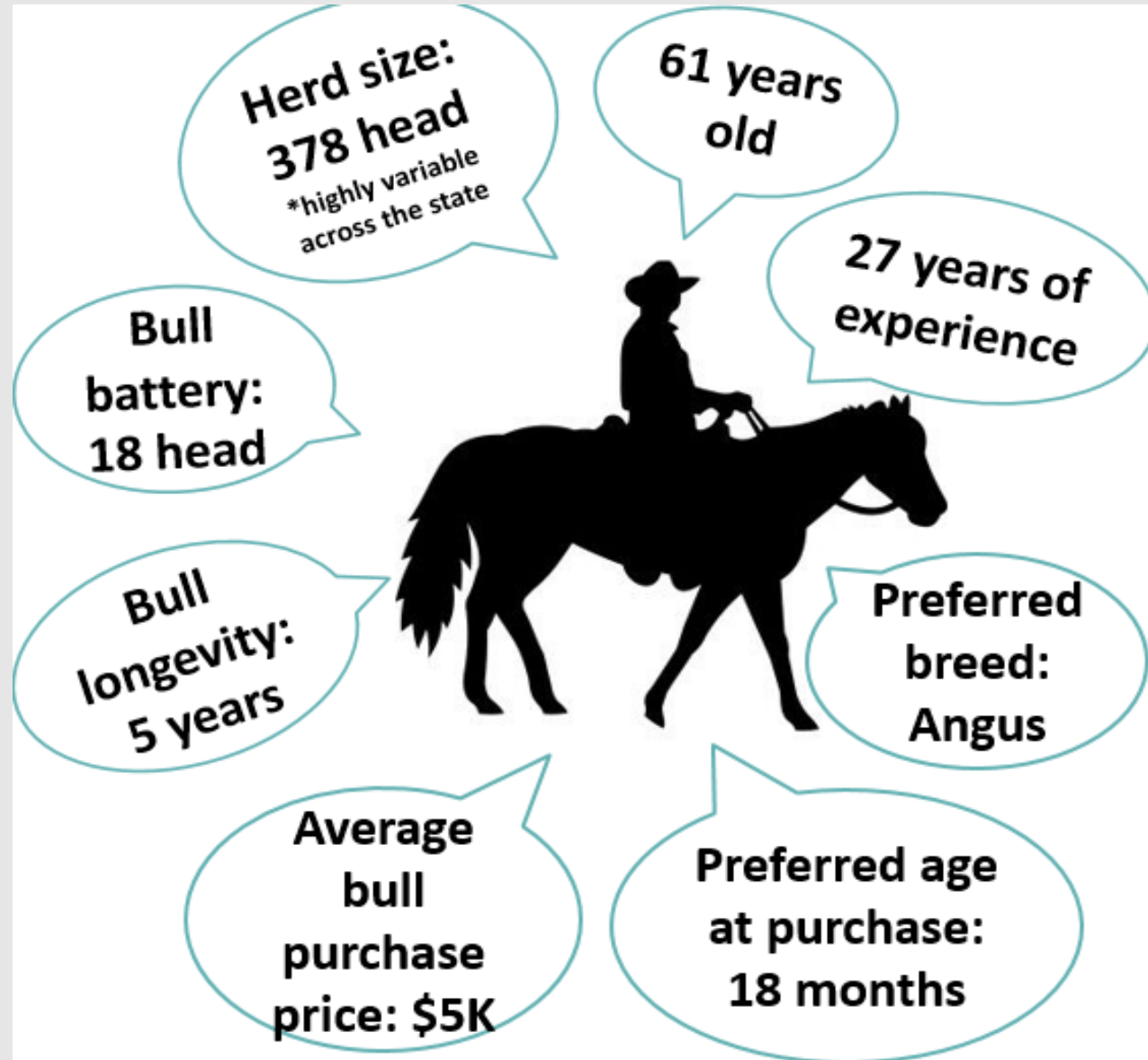
- Assess bull buyer decisions:
 - Selection
 - Purchase
 - Management

Survey Methodology:

- 1,140 surveys mailed to CCA memb
- 16% response rate (220 responses)
- Data analyzed with summary statistics and chi-square in SAS



California Producer Background



Expected Progeny Difference Priorities



High



Low

\$ Value Index EPD Value Priorities

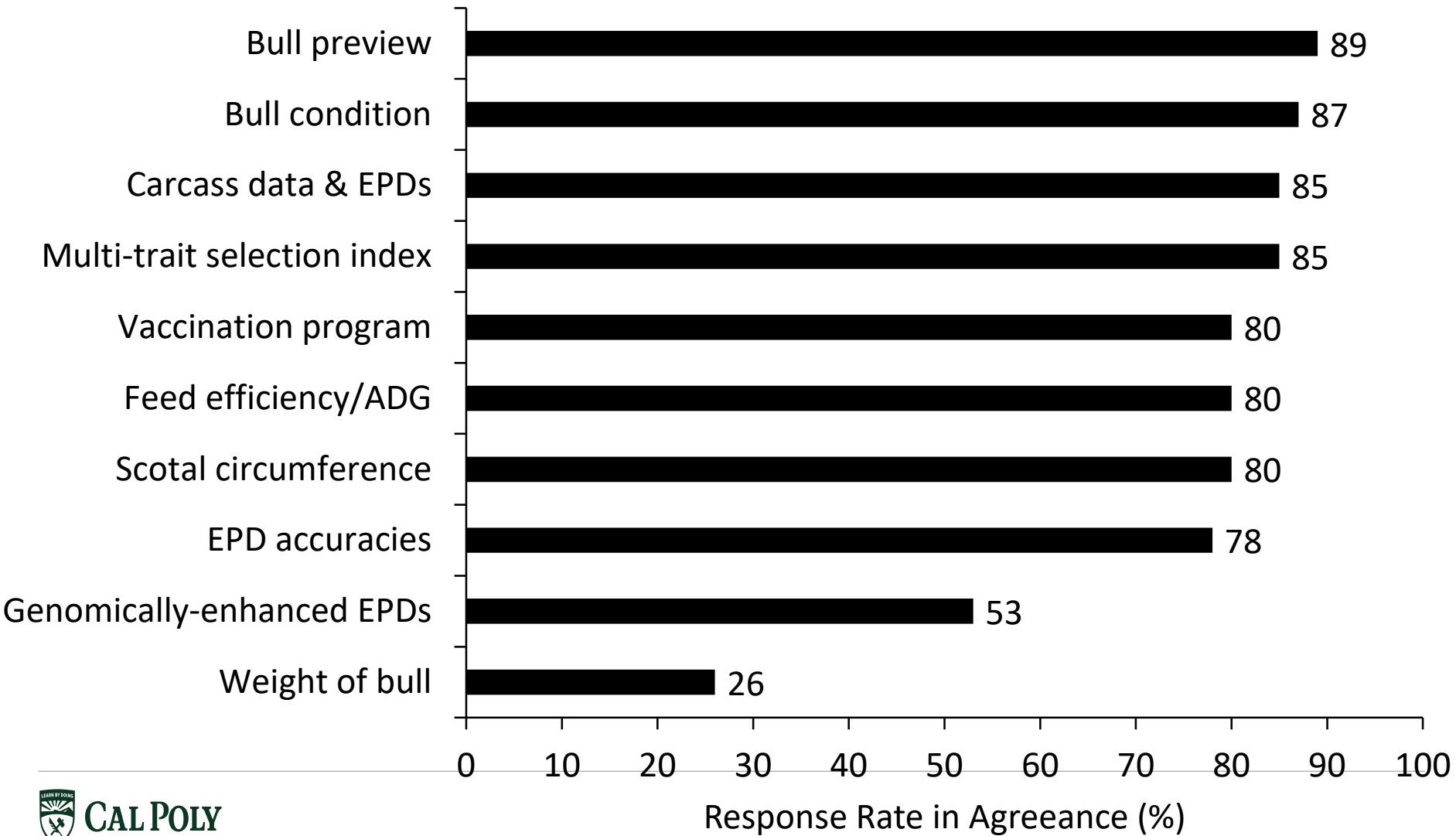


High

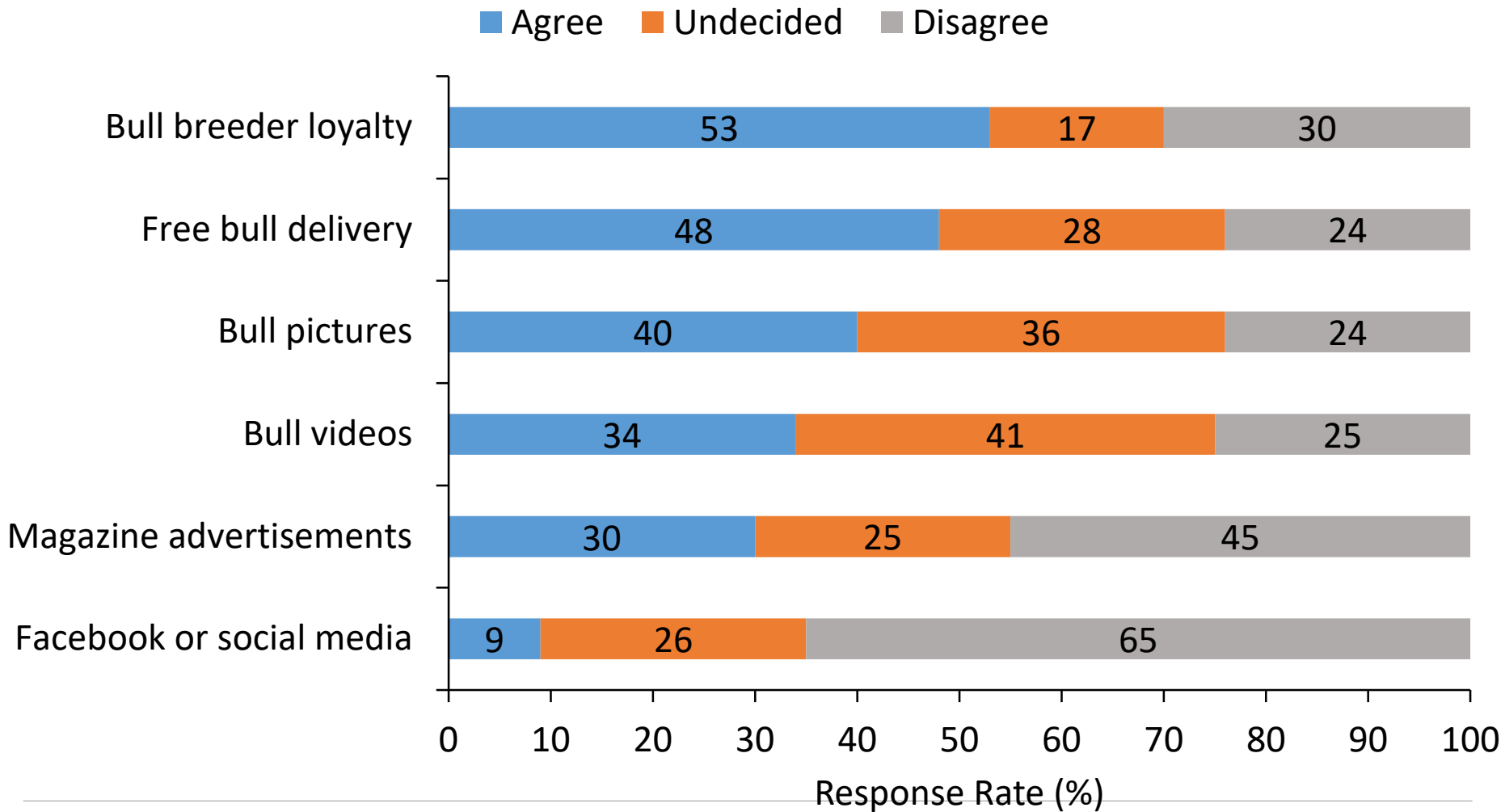


Low

Bull Selection Criteria



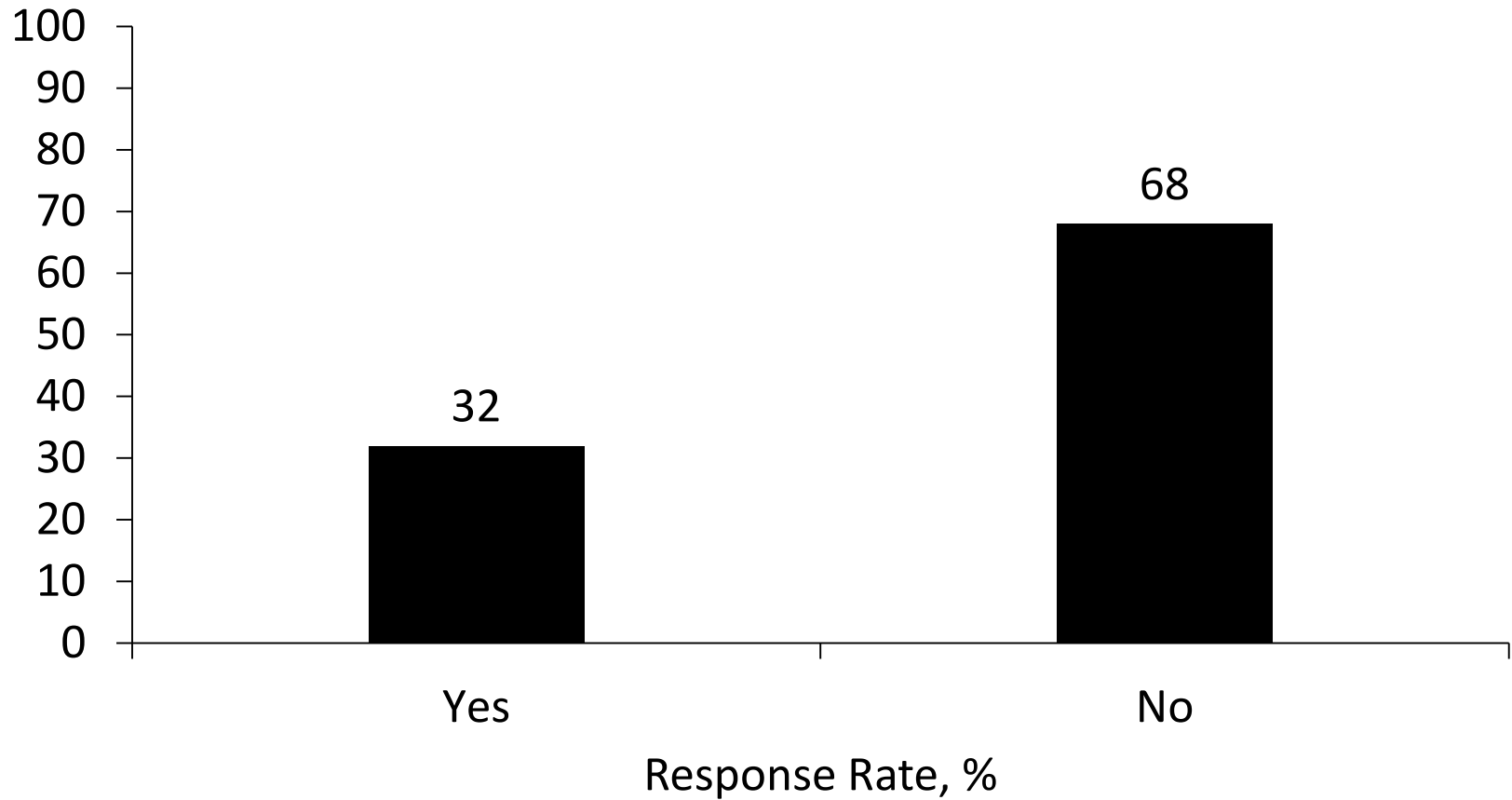
Bull Marketing



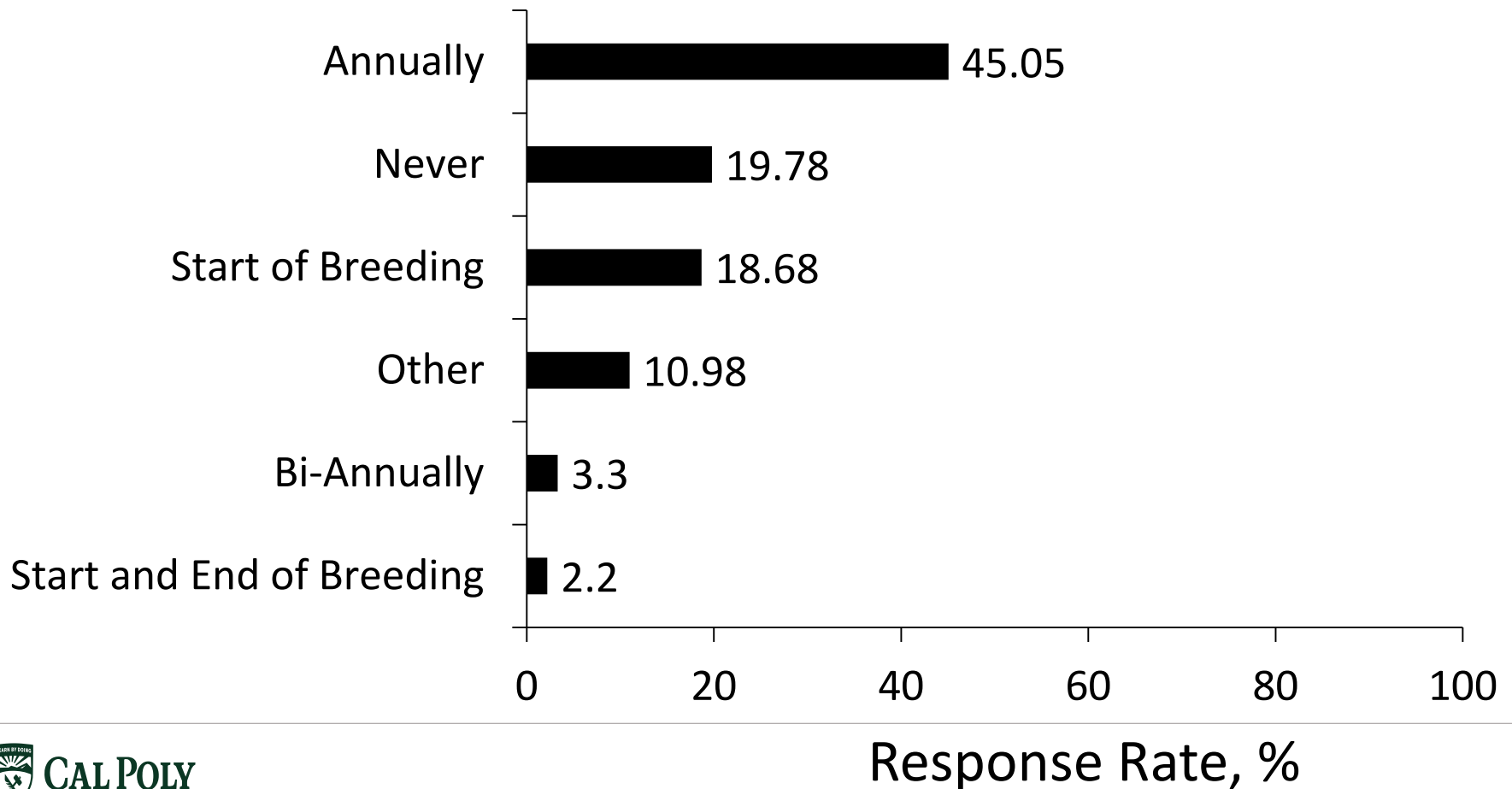
How do commercial producers manage bulls after purchase?

- Utilization of Artificial Insemination
- Frequency of semen quality analysis
- Management of bulls in the off-season
- Factors driving culling decisions

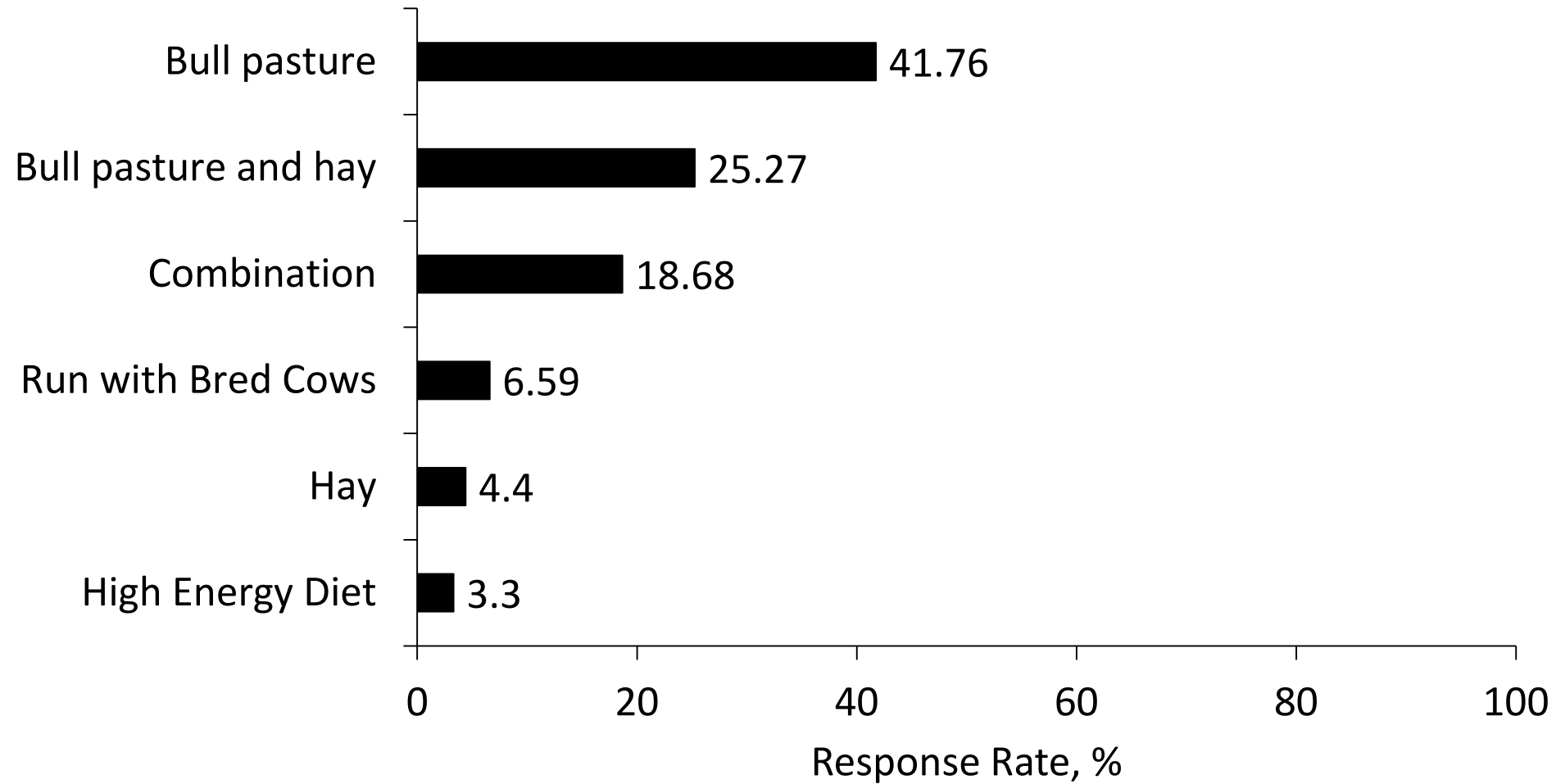
Utilization of Artificial Insemination



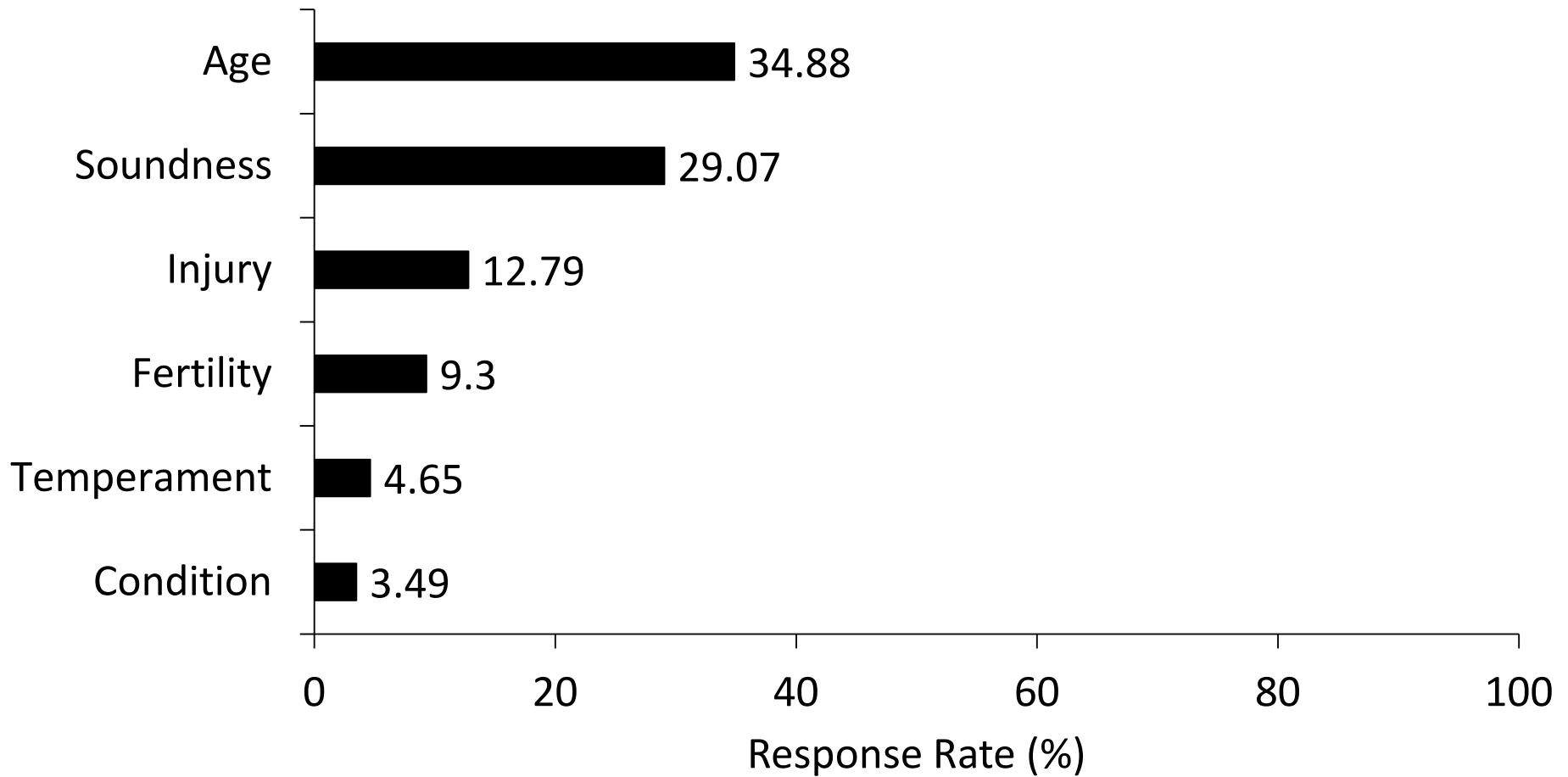
Frequency of Semen Quality Evaluation



Bull Off-Season Management



Primary Culling Criteria



How do we manage bulls to be successful?

- Critical Time Periods:
 - Pre-Weaning
 - Post-Weaning
 - Breeding Season
 - Pre- and post-breeding season

Pre-Weaning Development

- Are calves meeting their nutrient requirements from their mother's?
- What about first- and second-calf heifers?
- What about drought? Nutrient-deprivation?
- Many producers utilize creep (grazing or feeding)

Pre-Weaning Development

- Metabolic hormone production (Insulin, IGF, Leptin, etc.) responsible for the following:
 - Proliferation of Sertoli and Leydig cells
 - Scrotal circumference
 - Development of the testes
 - Age at puberty
- Plane of nutrition is critical!
- The first 25 weeks of age are critical during the pre-weaning period

Post-Weaning Development

- Majority of literature focused on this period
- Typically fed a high-energy diet
- Contemporary grouping

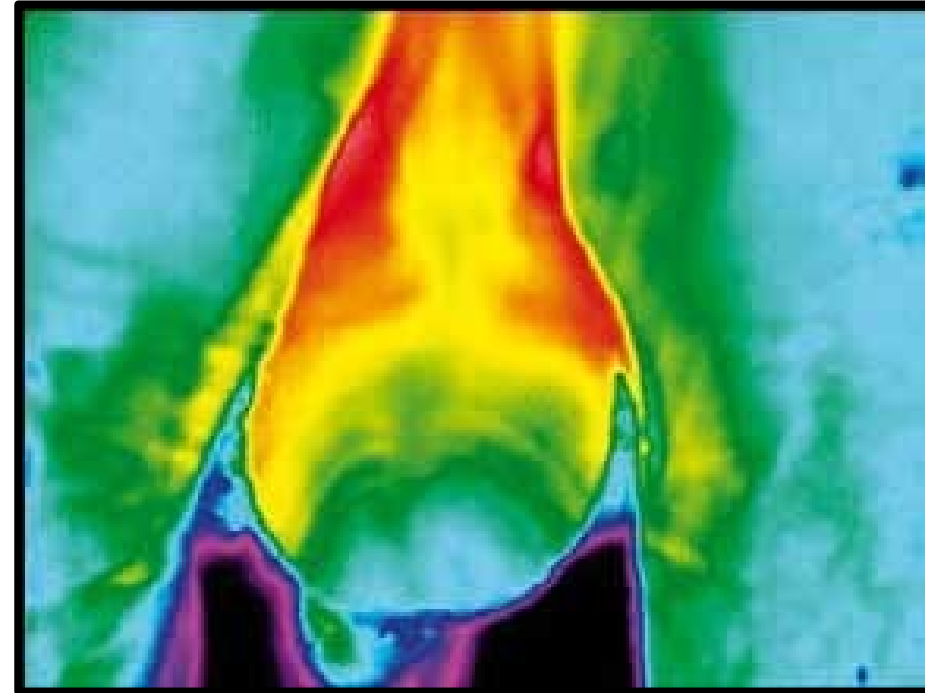
Post-Weaning Nutritional Management

- Moderate-Energy Diets:
 - Extended Period (120-160 d)
 - Marketed at 18-20 months of age
 - ↑ costs
 - ↑ semen quality
 - Longer generation interval
- High-Energy Diets:
 - Rapid Growth Rate
 - Market bulls around 15 months of age
 - Efficient and cost-effective
 - Shorter generation interval
 - Historically attributed to ↓ semen quality



Reductions in Semen Quality Post-Weaning

- High-energy diets fed post-weaning influence scrotal growth and semen quality
 - ↑ scrotal circumference
 - ↓ total sperm production
 - Delay epididymal transport
 - ↓ progressive motility
 - ↑ spermatozoa morphological abnormalities
 - ↑ scrotal temperature
 - Scrotal adiposity



Different Feeding Methodologies

- **COMP-fed pens**

- 1.75% of pen BW on d 1
- Feed increase every other d
 - 10% increase in DM
- *Ad-libitum* – 1-5% refusal
- Slick bunk *ad-libitum* on d 63

- **TMR-fed pens**

- 1.50% of pen BW on d 1
- Feed increase every third d
 - 7.5% increase in DM
- Slick bunk *ad-libitum*

TMR



Bulk density = 143.50 kg of DM x cubic m⁻¹

Pellet



Cereal rye hay



Bulk density = 564.68 kg of DM x cubic m⁻¹

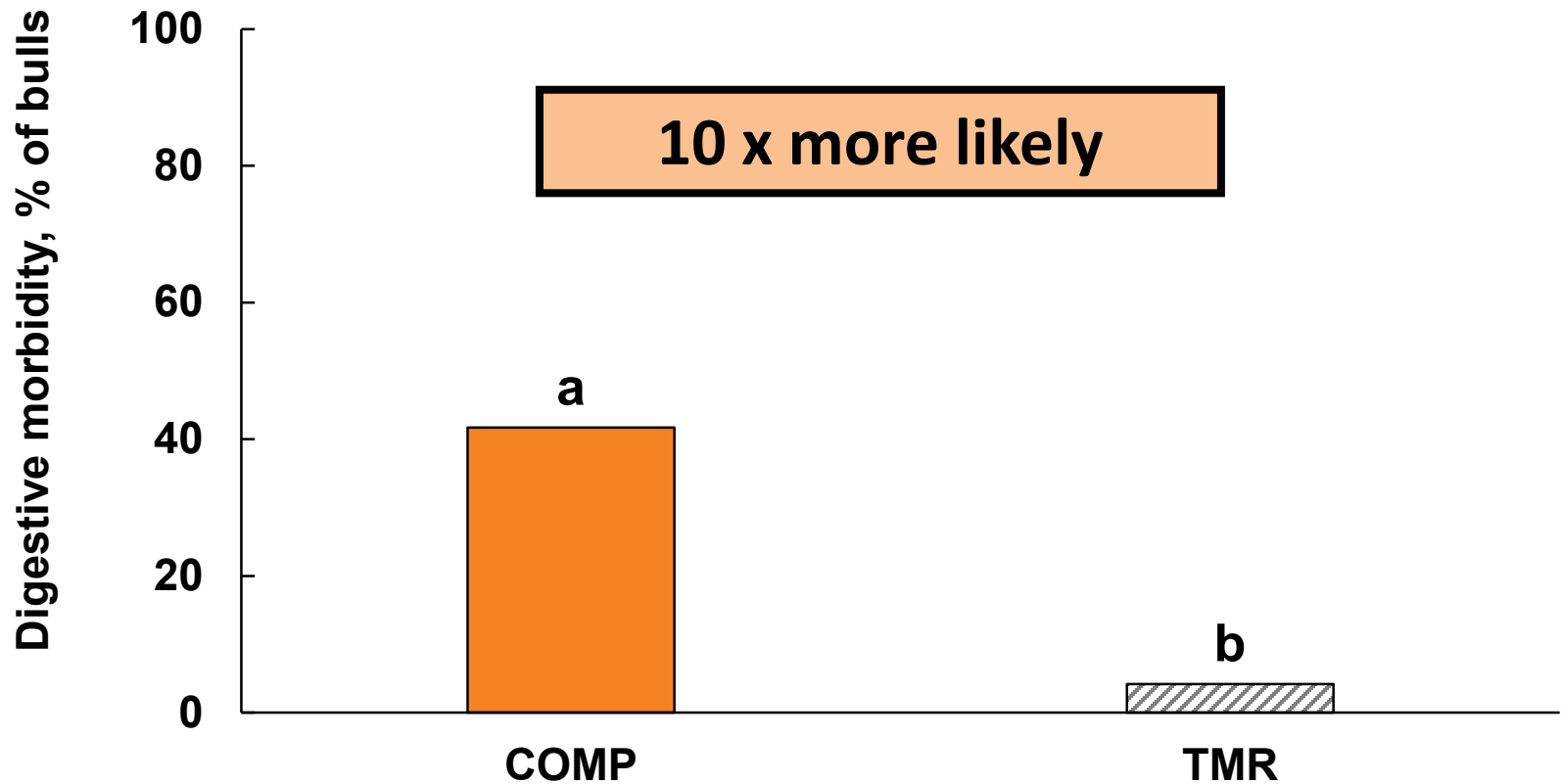
Proctor et al., 2019 unpublished data

Growth Performance

Item	COMP	TMR	Pooled SEM	P – value
Initial BW, kg	377.8	375.1	2.1	0.76
Final BW, kg	6% increase		4.3	< 0.01
ADG, kg x day ⁻¹	17% increase		0.05	< 0.01
DMI, kg x day ⁻¹	14% increase		0.17	< 0.01
Feed efficiency, kg of BW x kg of DM ⁻¹	0.221	0.215	0.003	0.19

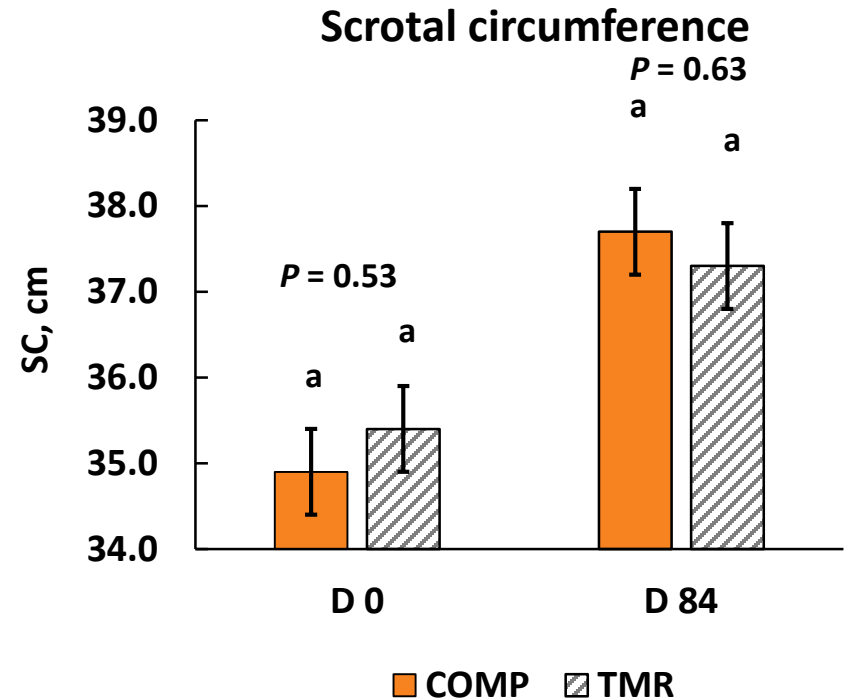
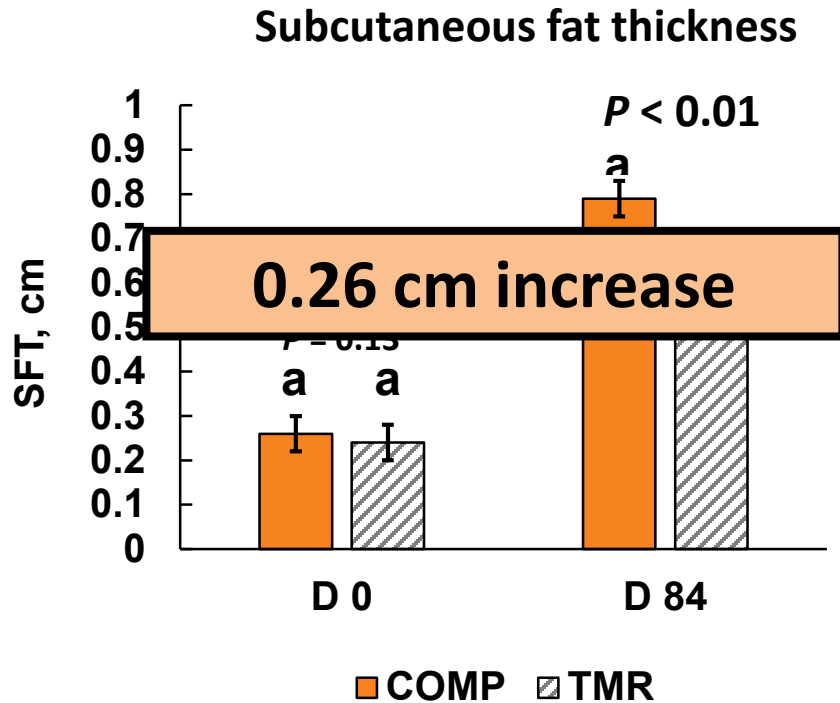
Proctor et al., 2019 unpublished data

Digestive Morbidity



^{a,b}Bars without a common letter differ ($\chi^2 = 5.93$; $P < 0.01$).

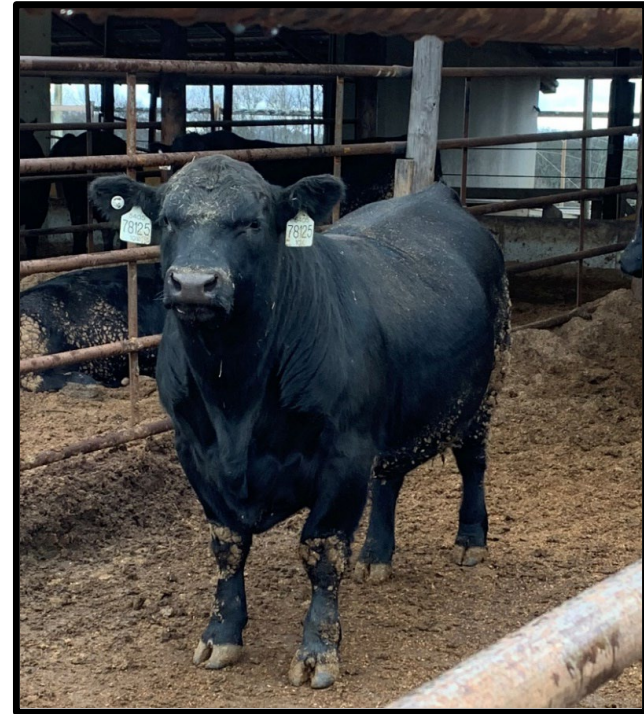
Subcutaneous Fat Thickness and Scrotal Circumference



^{a,b}Bars without a common letter differ ($P < 0.05$)

Breeding Soundness Exam Passage Rate

- Diet did not influence the likelihood of BSE passage
 - $\chi^2 = 0.87; P = 0.65$



Summary

- Bulls fed the COMP ration:
 - ↑ DMI, ADG, and the likelihood of digestive morbidity
 - ↓ rumen pH to thresholds indicative of subacute ruminal acidosis
- Diet did not affect semen quality or the likelihood of BSE passage
- Diets resulting in rapid weight gain:
 - ↑ adiposity
 - Digestive morbidity
- Bulls can be pushed without impacting semen quality
- But what happens during the breeding season?

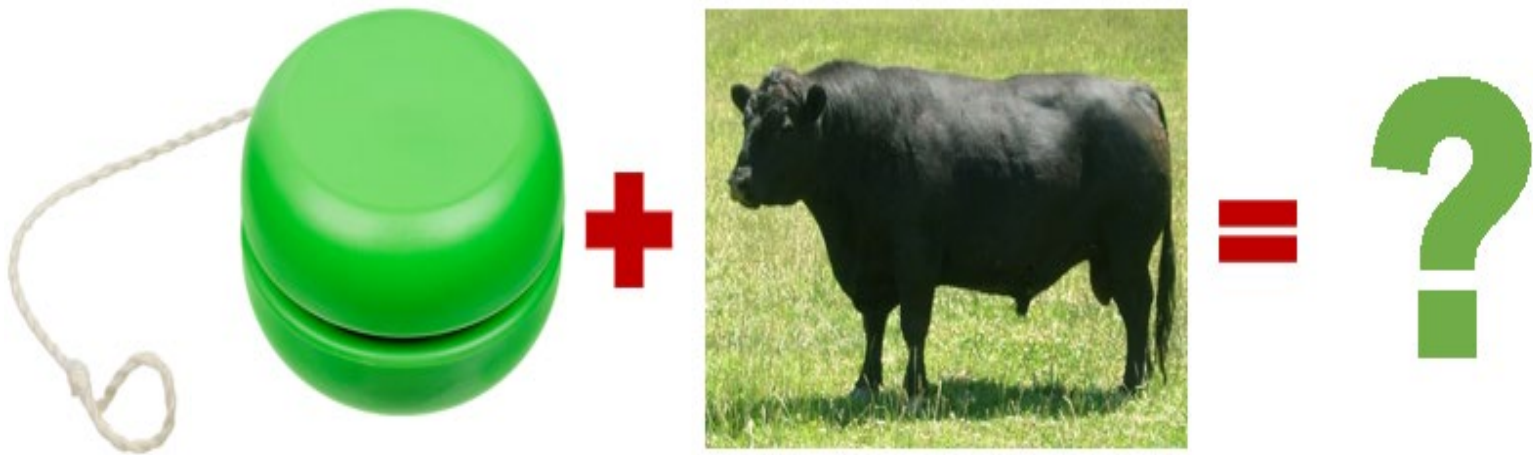


Breeding Season Management

Breeding Season

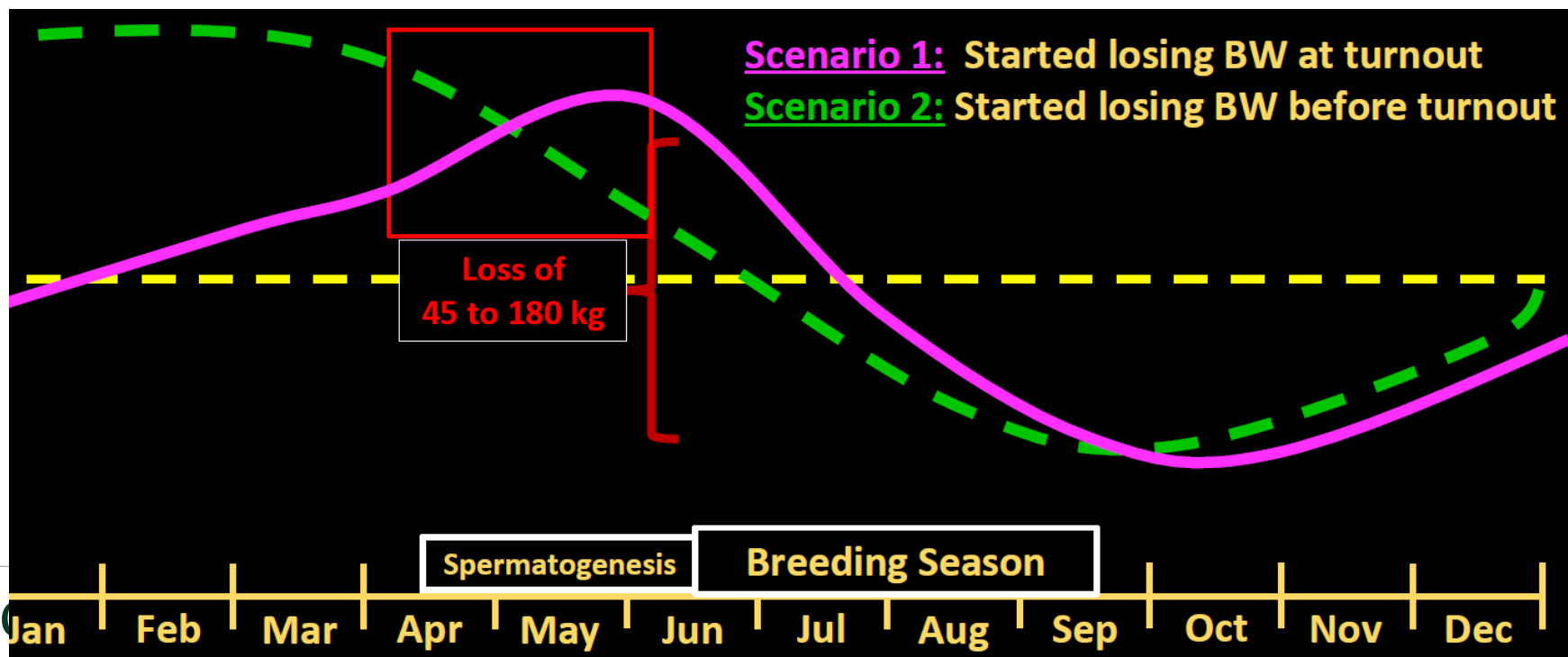
- What is the length?
- What is the bull:cow ratio?
- Do you AI? How long until you turn out bulls?
- How do you manage bulls prior to the breeding season?
- How do you manage the recovery period?

Bull Body Weight Fluctuation



Plane of Nutrition Impacts on Metabolism and Body Composition

- Divergent planes of nutrition (**Dahlen et al., 2020**)
- BW, BCS, Scrotal Circumference, ultrasound characteristics (e.g. LM Area, % IMF) diverged
- Hormones and metabolites reflected plane of nutrition divergence
 - e.g. Serum NEFA greater in NEG bulls



Plane of Nutrition Impacts on Measurements of Fertility

- Impacts on scrotal circumference:
 - NEG bulls had lower scrotal circumference during the enter study period (**Dahlen et al., 2020**)
- Plane of nutrition indicate altered motility and kinematic properties of sperm in frozen-thawed semen, but not fresh semen (**Dahlen et al., 2020**)

Materials & Methods

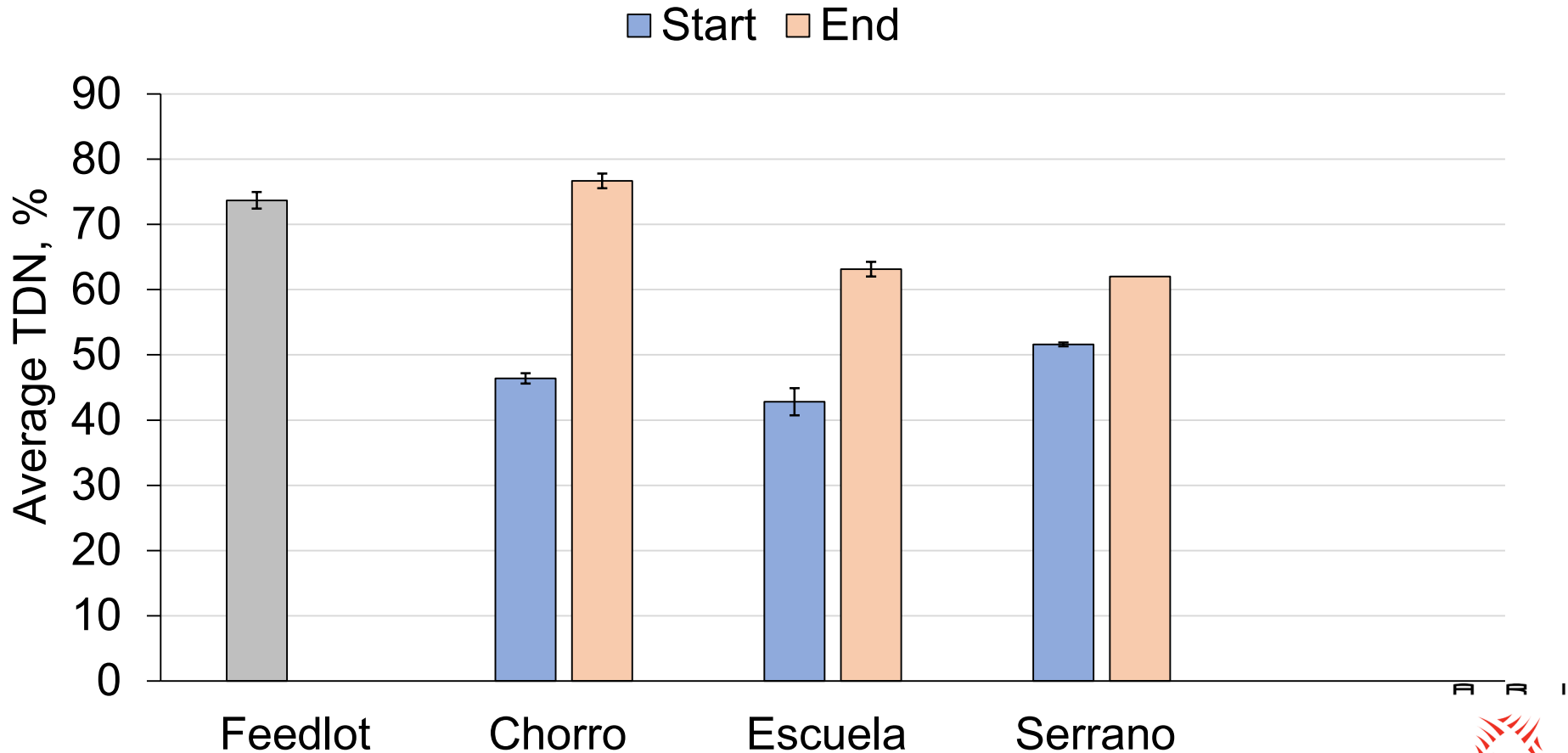
- 3 ranches
 - Chorro = 50 head, and 582 acres
 - Escuela = 150 head, and 1819 acres
 - Serrano = 80 head, and 1500 acres
- 2-3 bulls per ranch
- 2-year-old bulls



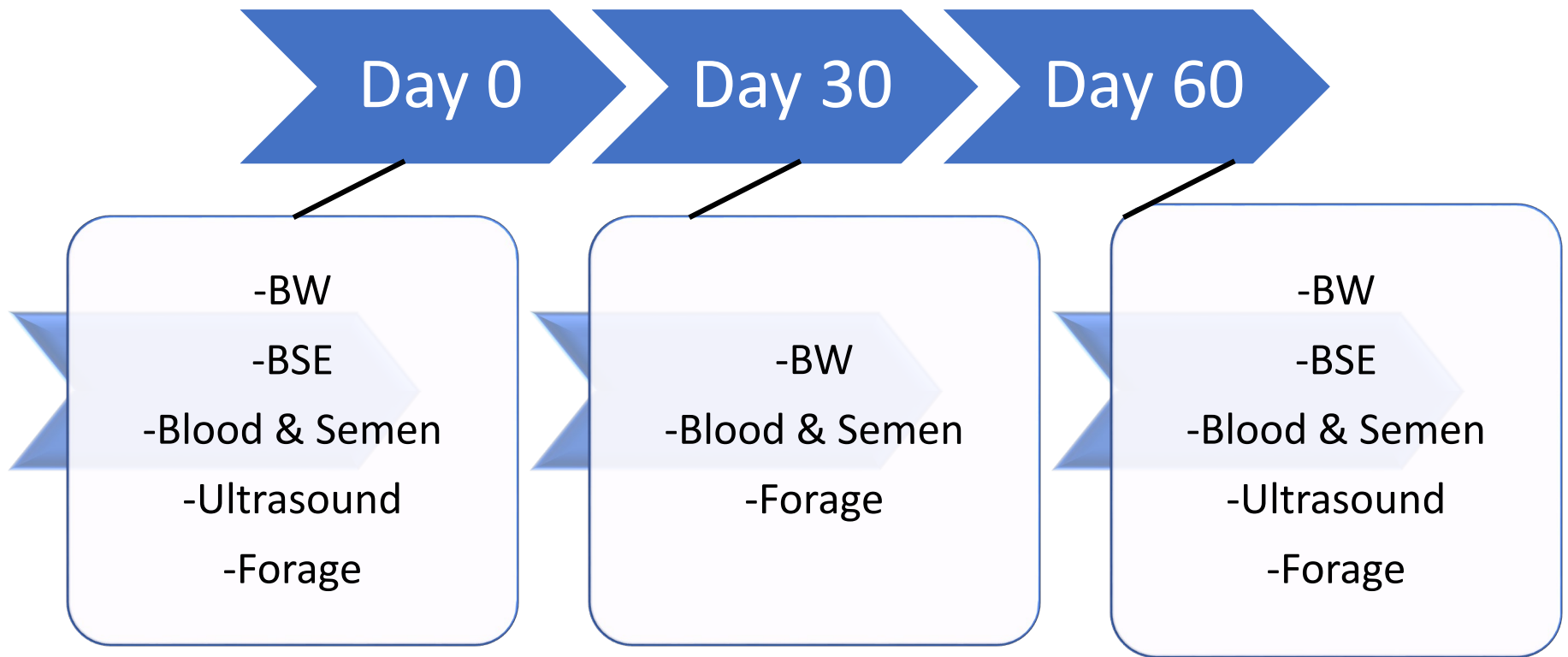
Bull Nutritional Management Prior to Breeding Season

Item	As Fed Basis
Ingredients, %	
Corn, steam flaked	19.71
Almond hulls	18.59
Distillers dried grains w/ solubles	7.44
Mineral premix	5.58
Molasses	14.13
Oat Hay, suncured	26.02
Alfalfa hay, suncured full-bloom 13	8.55

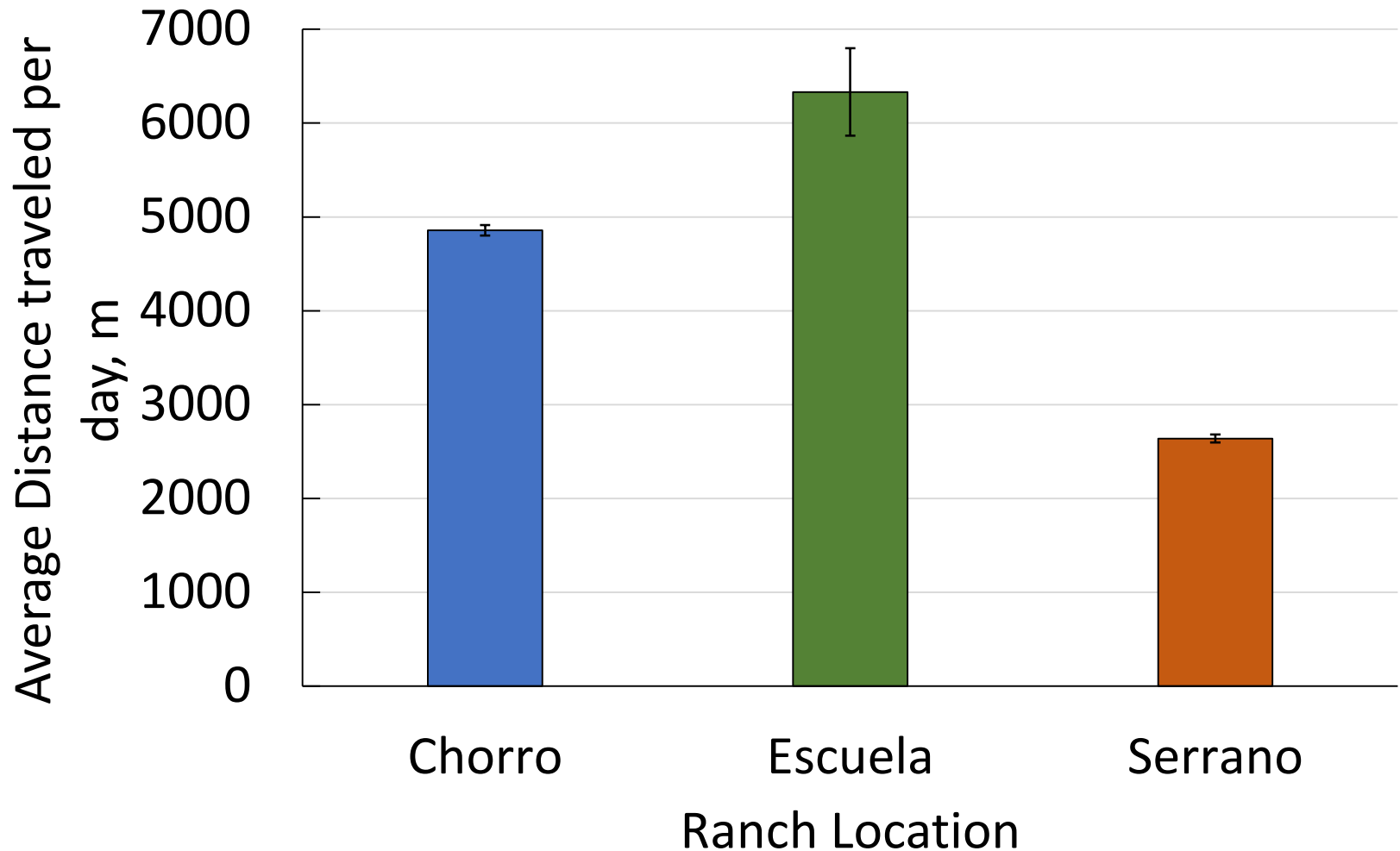
Forage Quality by Ranch Location



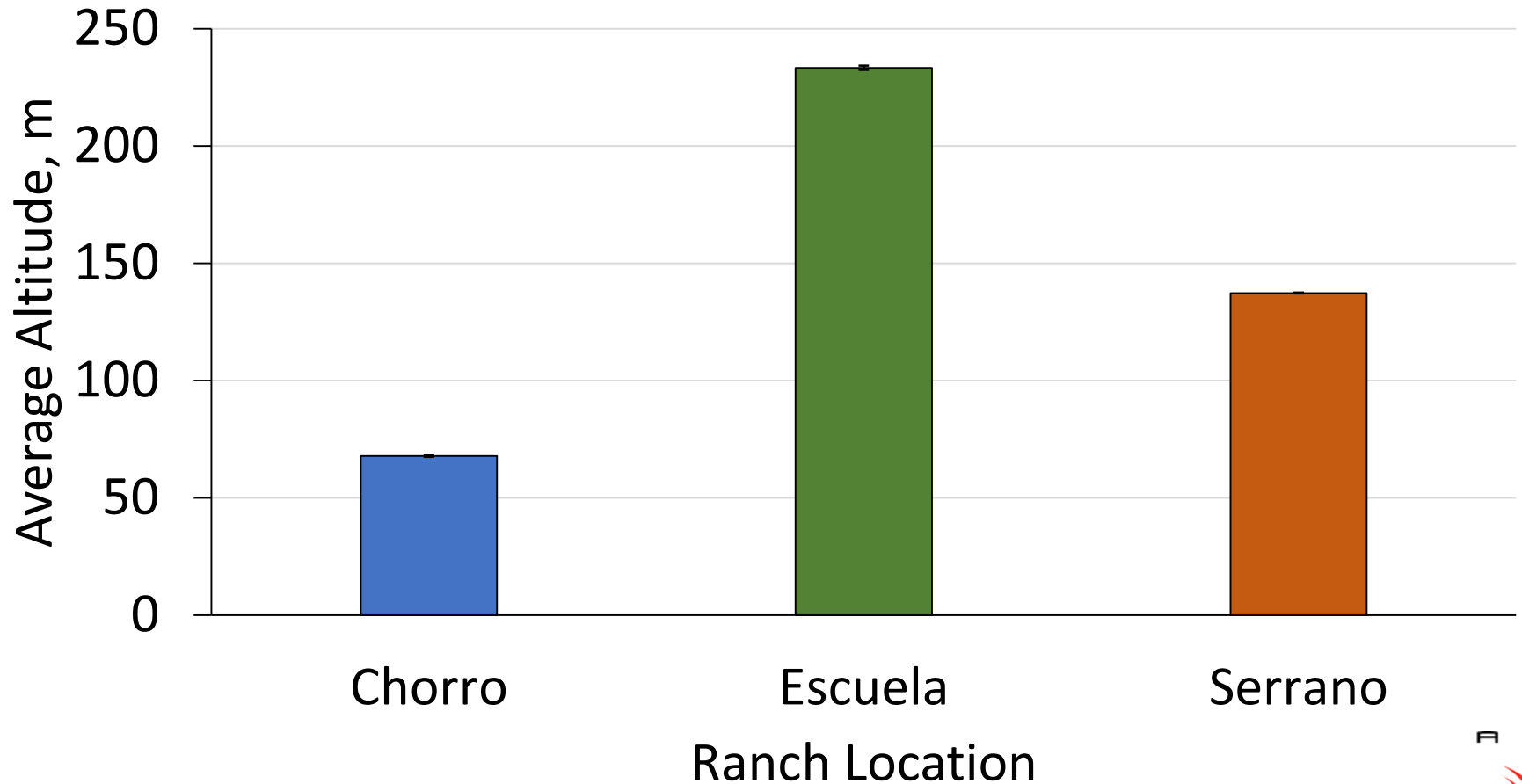
Sample Collection & Timeline



Distance Traveled by Ranch Location



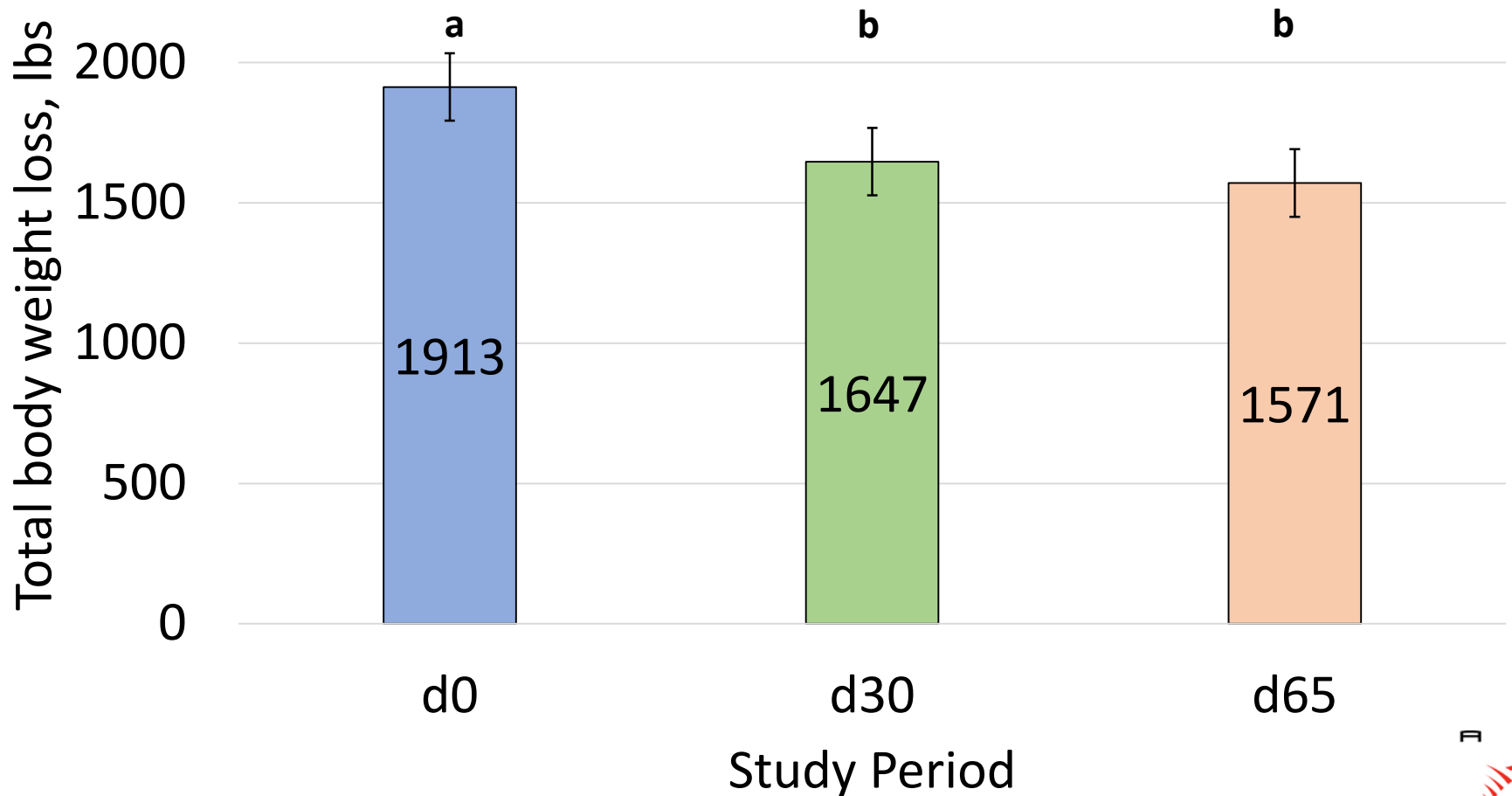
Altitude Change by Ranch Location



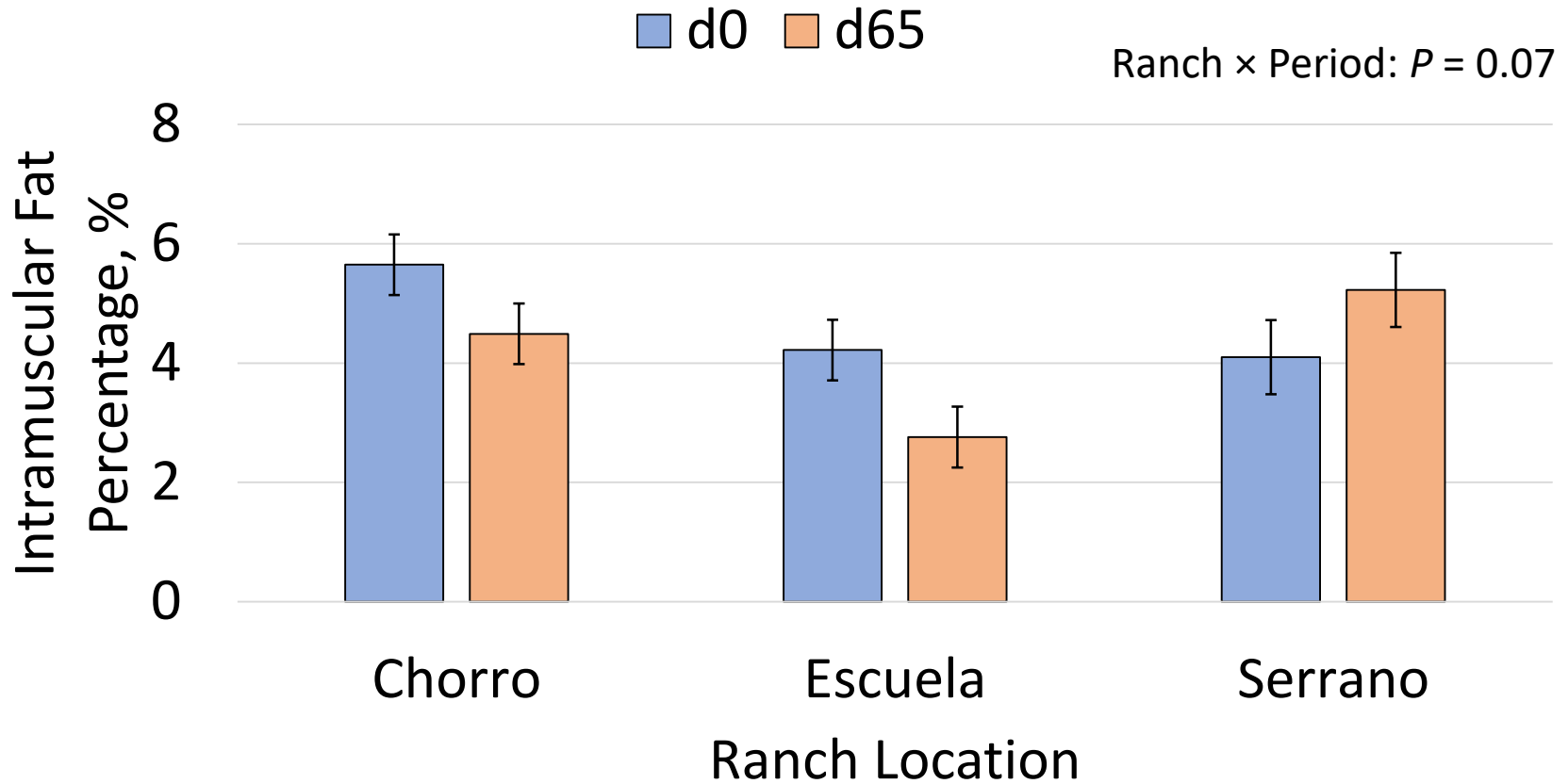
Bull Body Weight Loss by Study Period

Ranch Location: $P = 0.53$

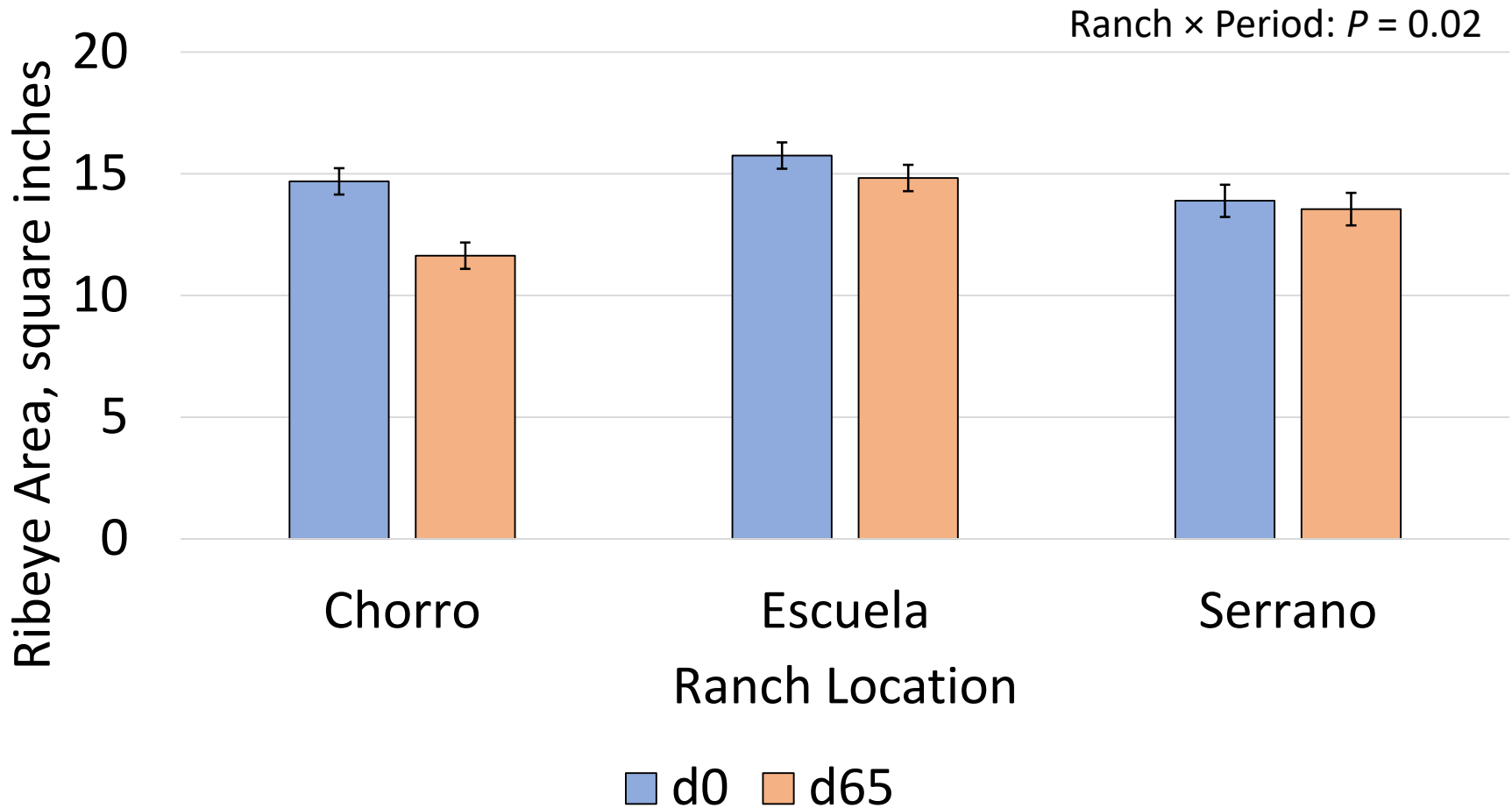
Study Period: $P = 0.05$



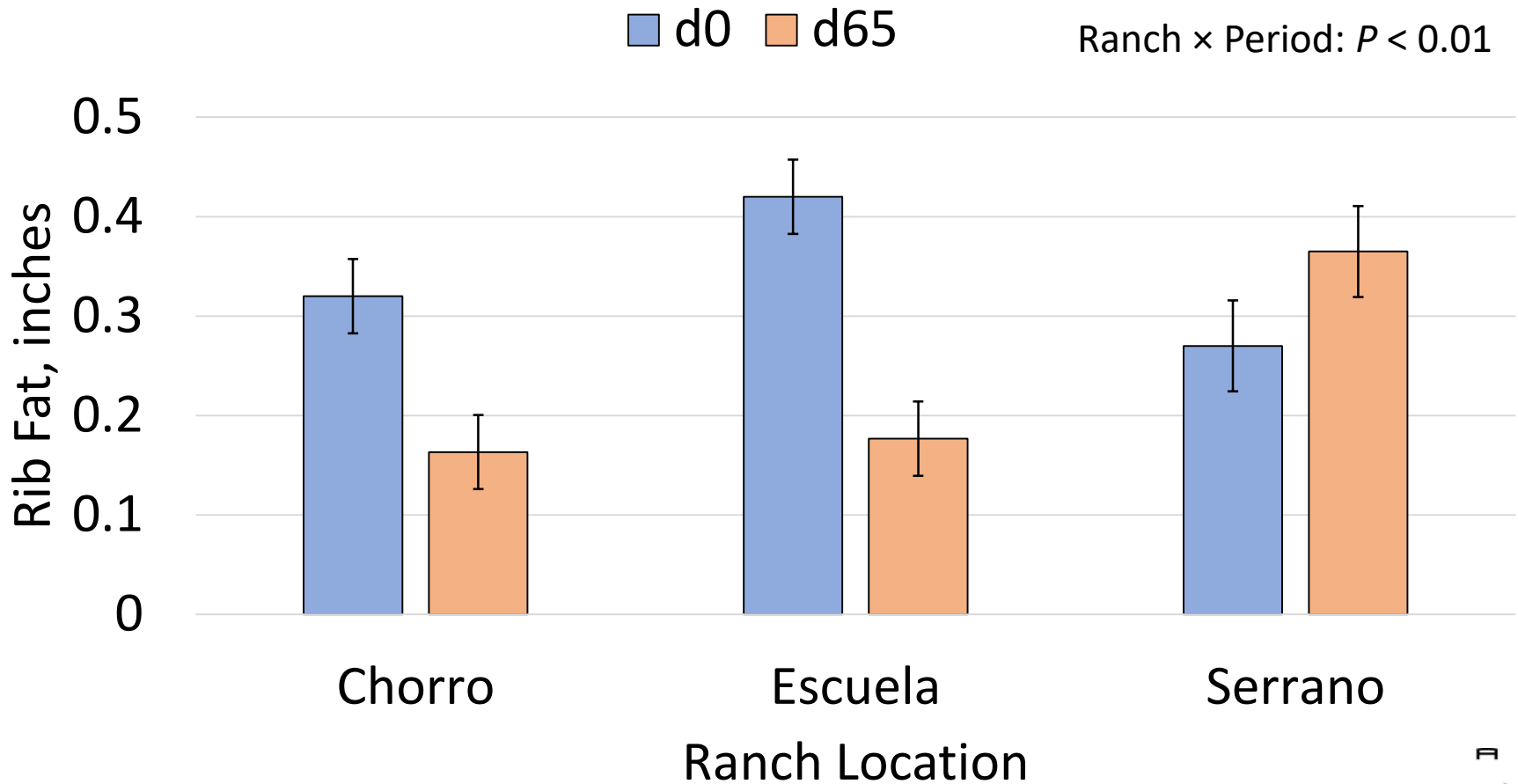
Ultrasound Characteristics: IMF%



Ultrasound Characteristics: REA



Ultrasound Characteristics: Rib Fat



Semen Quality

- Scrotal circumference was not influenced by ranch location or by period ($P \geq 0.55$)
- Sperm Motility and Morphology were also not influenced by ranch location or period ($P \geq 0.43$)

Summary

- Pre- and post-weaning development is crucial for growth and maturation of testes and body composition
- Nutritional management can influence body weight and adiposity, but may not impact semen quality
- Breeding season drastically reduces body weight and alters body weight composition
- More research is necessary to determine the impact of body weight fluctuation and physical activity on semen quality

Future Work

- GPS data analysis
- Serum and seminal fluid metabolomics
- Parentage testing
- Nutritional management treatments (Range vs. Feedlot)

Acknowledgments

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Questions?



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