Metabolic Signals of the Beef Cow in Negative Energy Balance

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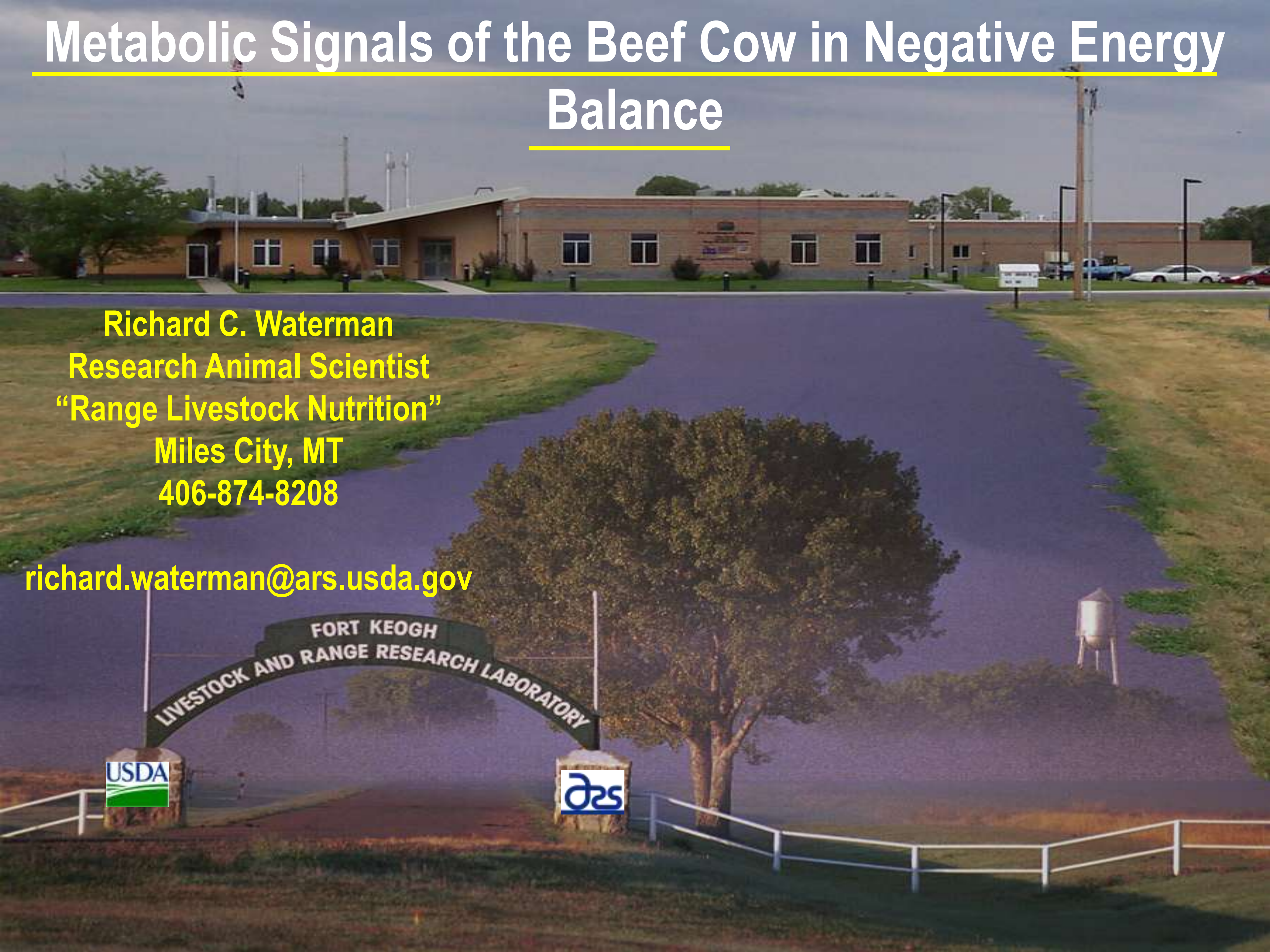
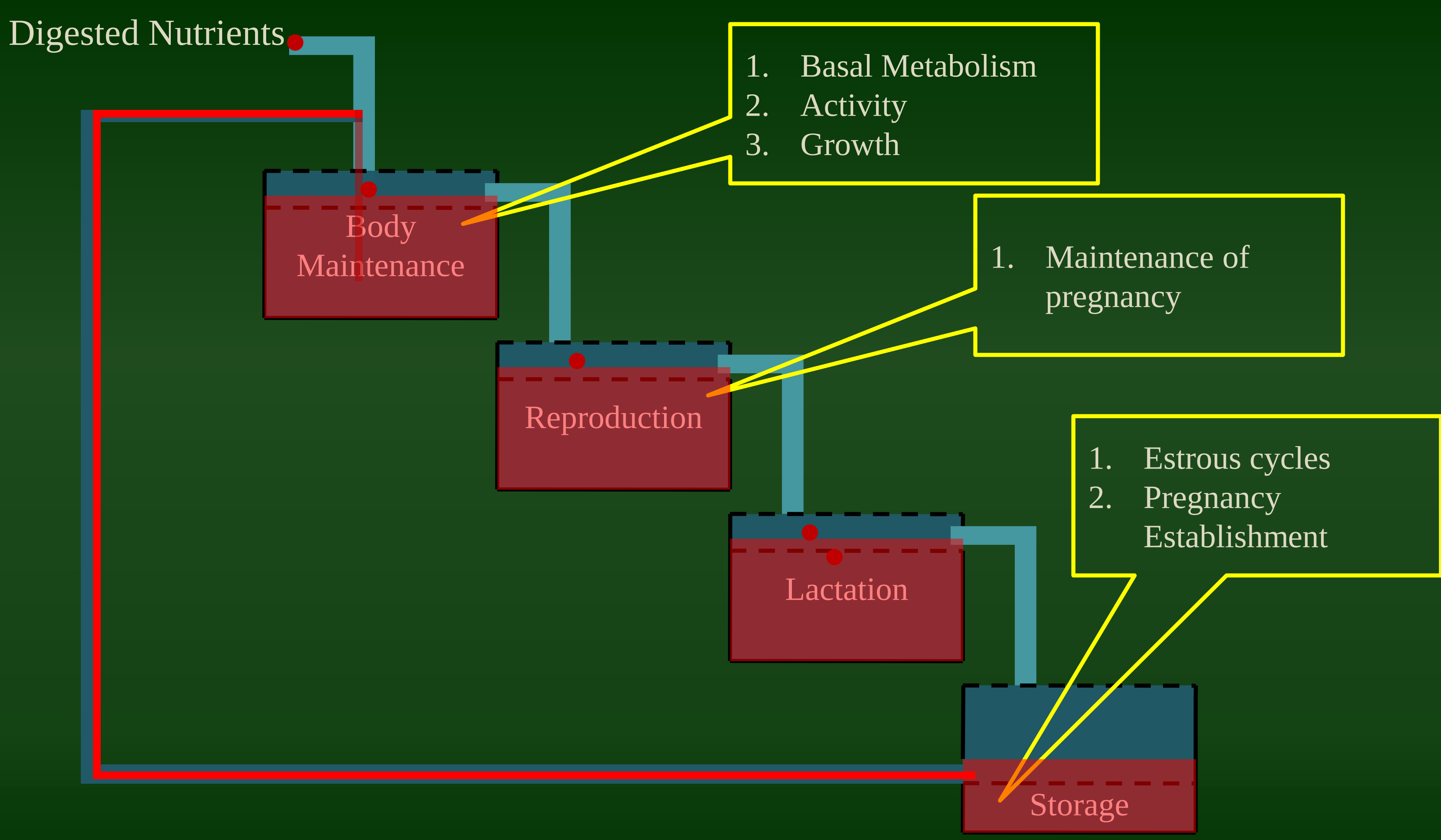


Influences on nutrient utilization

Prioritization of nutrient use by Ruminants



Why are ruminants unique?

- Their 4 chambered stomach!
  - Rumen → Large fermentation compartment
    - Microbes have first opportunity at consumed feeds
  - Fermentation end products produced by microbes
    - Are responsible for supplying precursors for energy
      - (Supply the fuel for the motor)
      - The primary volatile fatty acids is Propionate
        - Other important volatile fatty acids are Acetate and butyrate.

So Propionate and also glucogenic amino acids can go towards making Glucose and Glucose is the fuel (energy source) for ruminants.

INCREASING GLUCOGENIC PRECURSORS IN RANGE SUPPLEMENTS FED TO YOUNG POSTPARTUM BEEF COWS SHORTENS POSTPARTUM INTERVAL AND INSULIN RESPONSIVESS

Feed Ingredients used in each Supplemental Treatment

	Supplements %		
Feed	Logluc	Midgluc	Higluc
Cottonseed meal	65.6	24.8	33.0
Wheat middlings	14.3	42.5	22.7
Molasses	9.0	9.0	9.0
Urea	0.7	0.7	0.7
Hydrl. Poul. FM	0.0	20.0	20.0
NutroCal™	0.0	0.0	11.0
47.5% Soybean meal	8.9	0.0	0.0
Potassium Chl.	0.9	1.7	1.9
Dical Phosphate	0.3	1.0	1.5
Trace elements[a]	0.2	0.2	0.1

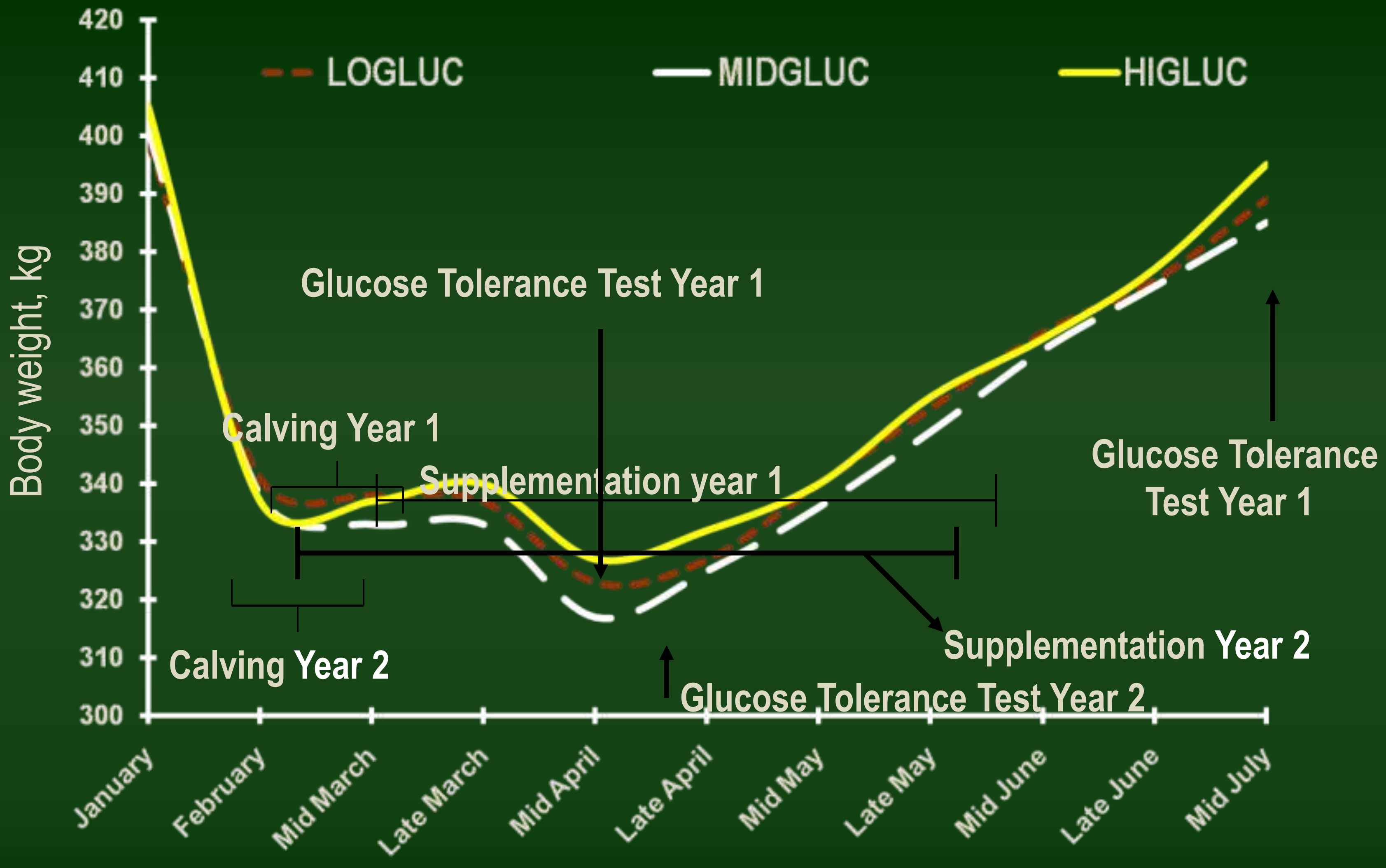
[a]Trace elements were fortified with Sodium selenite, Zinc oxide, and Copper chloride.

Nutrient Composition (As Fed Basis)

	Supplements %		
Nutrient Composition g/d	Logluc	Midgluc	Higluc
As fed lb cow^{-1}•d^{-1}	2.0	2.0	2.0
TDN	1.38	1.31	1.39
CP	0.72	0.72	0.72
RDP	0.46	0.37	0.36
RUP	0.26	0.35	0.36
Est. Glucogenic Potential[a]	0.10	0.14	0.32

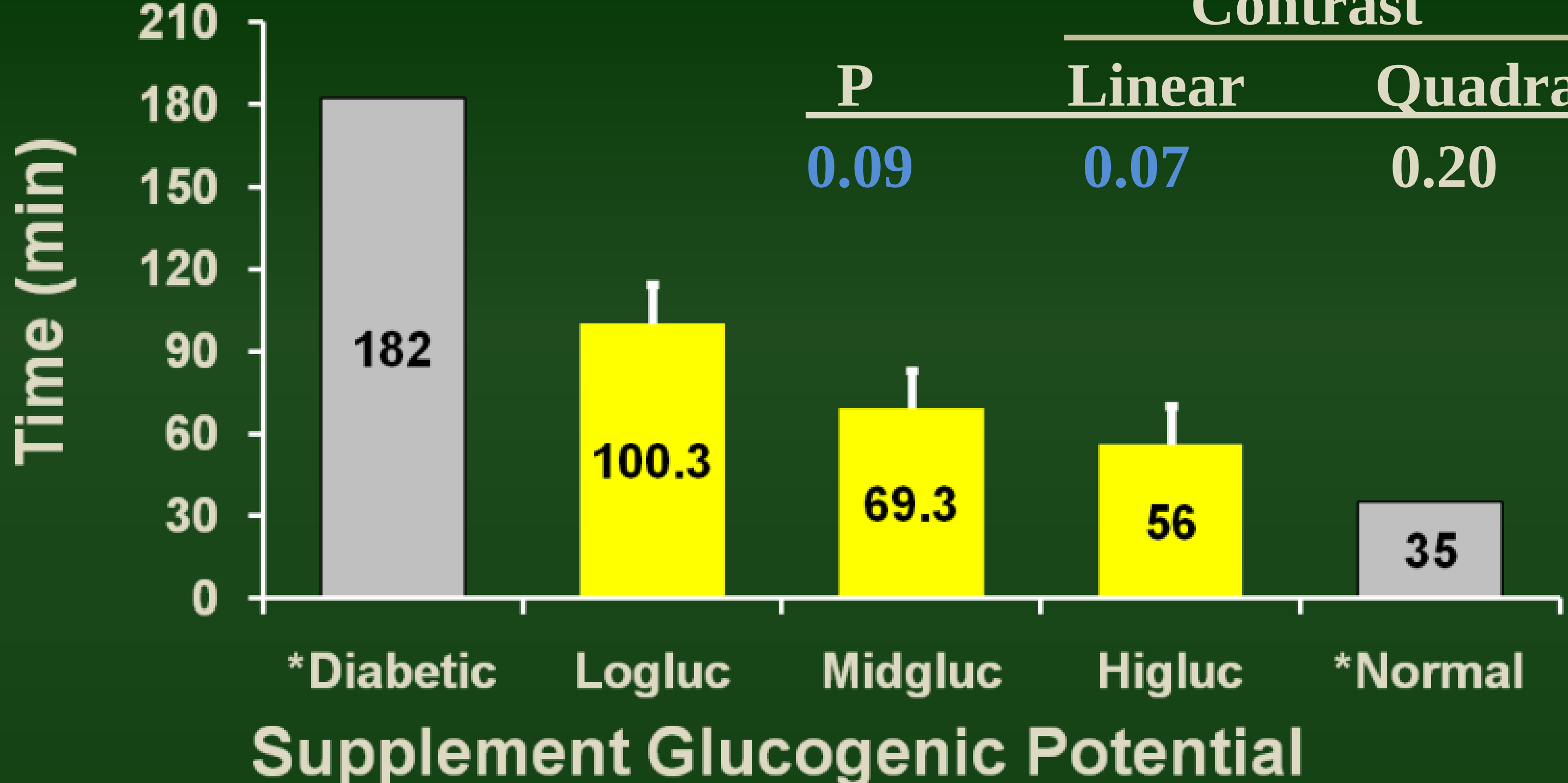
[a]Calculated using .40 x RUP as described by Preston and Leng, 1987

Body Weight Change in Relation to Specific Events



Waterman et al., 2006

Glucose Half-life – April Glucose Tolerance Test

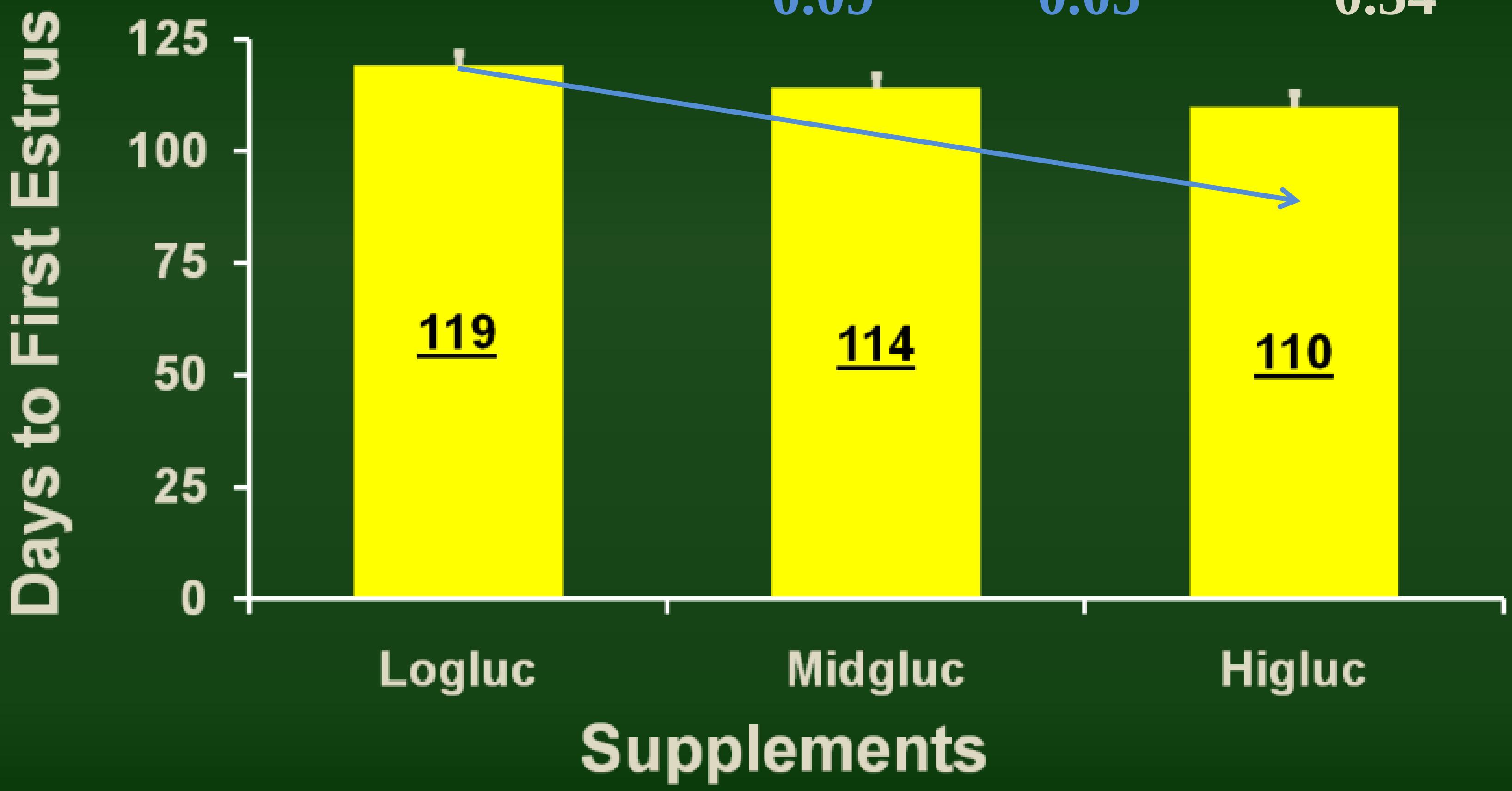


P	Contrast Linear	Contrast Quadratic
0.09	0.07	0.20

*Kaneko, 1989

Days to First Estrus Determined by Weekly Blood Samples

P	Contrast: Linear	Contrast: Quadratic
0.09	0.05	0.34

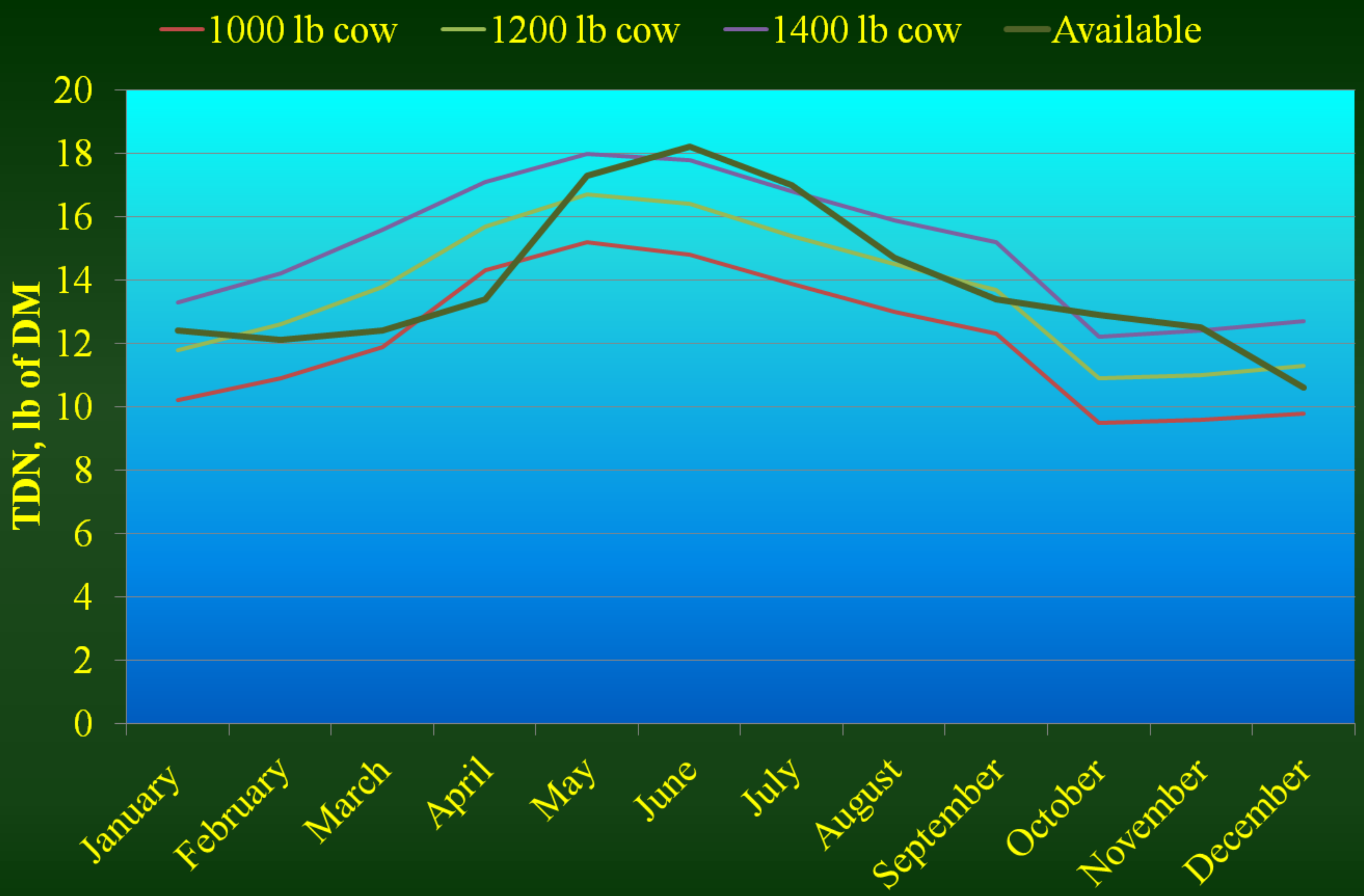


Supplement Cost

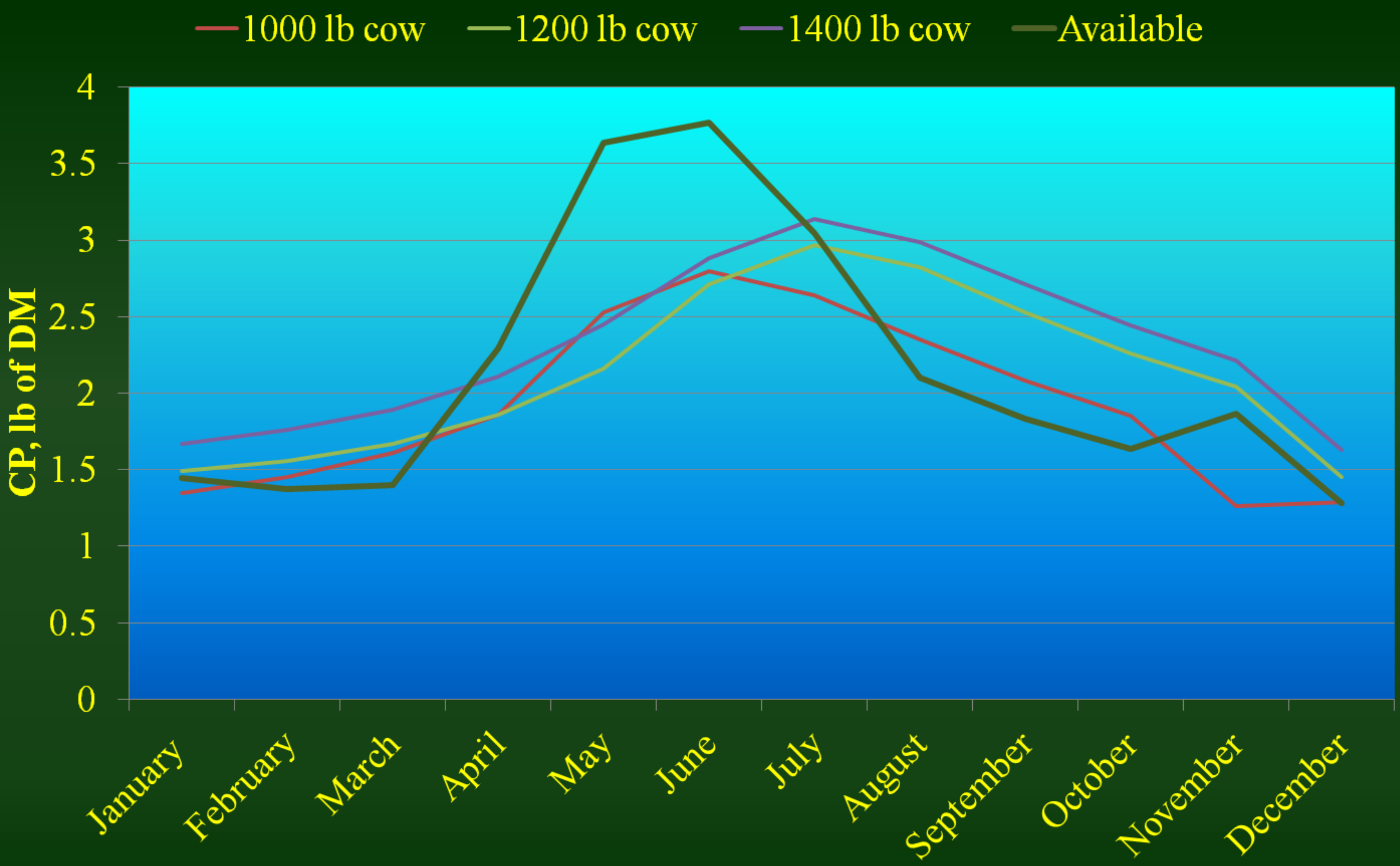
	Treatment		
Item	Logluc	Midgluc	Higluc
Cost, $ animal^{-1}	21.58	21.32	38.58
$ animal/d	0.23	0.22	0.41

Published in Journal of Animal Science 2007

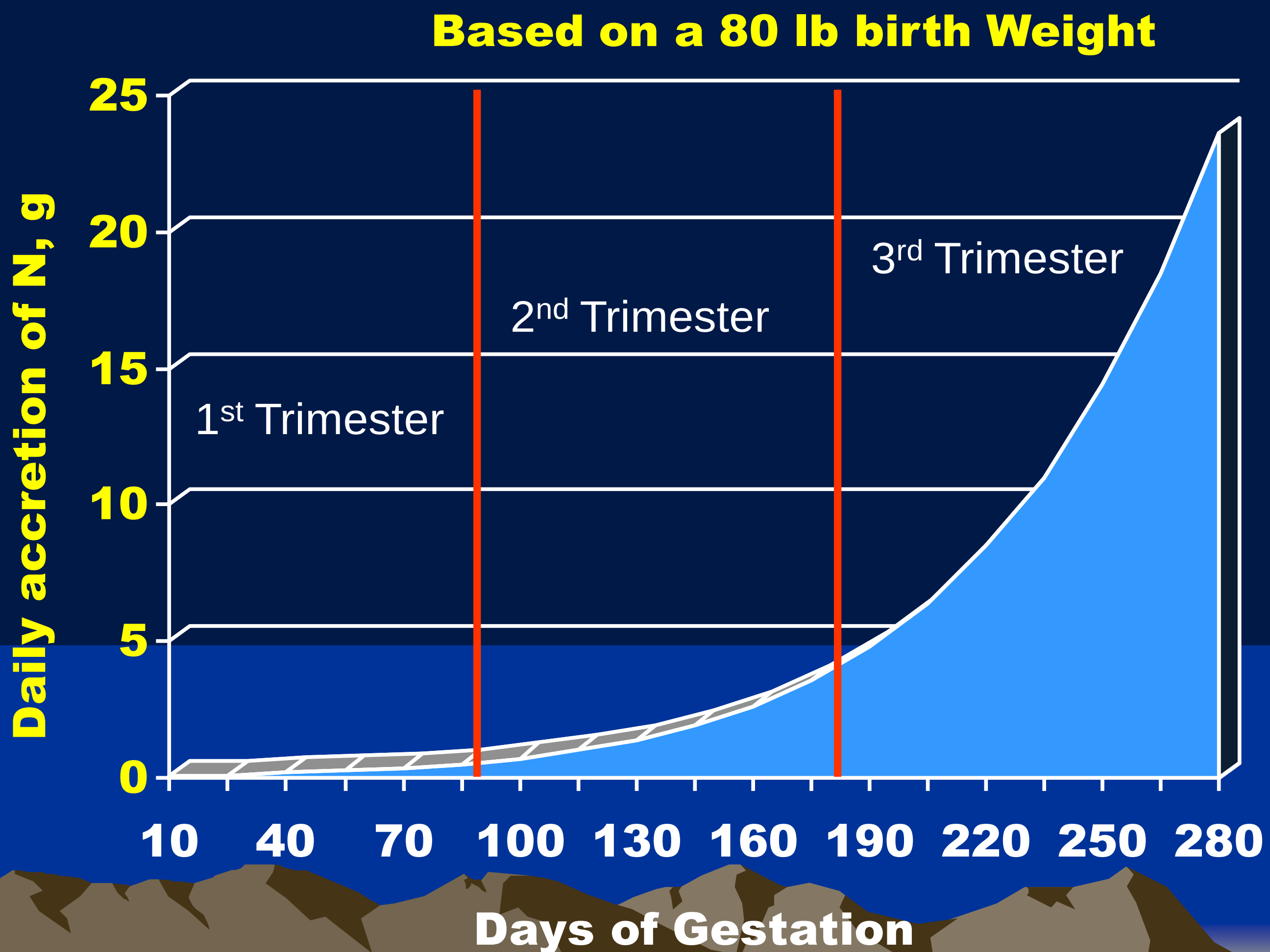
Requirement -Total Digestible Nutrients



Requirement – Crude Protein

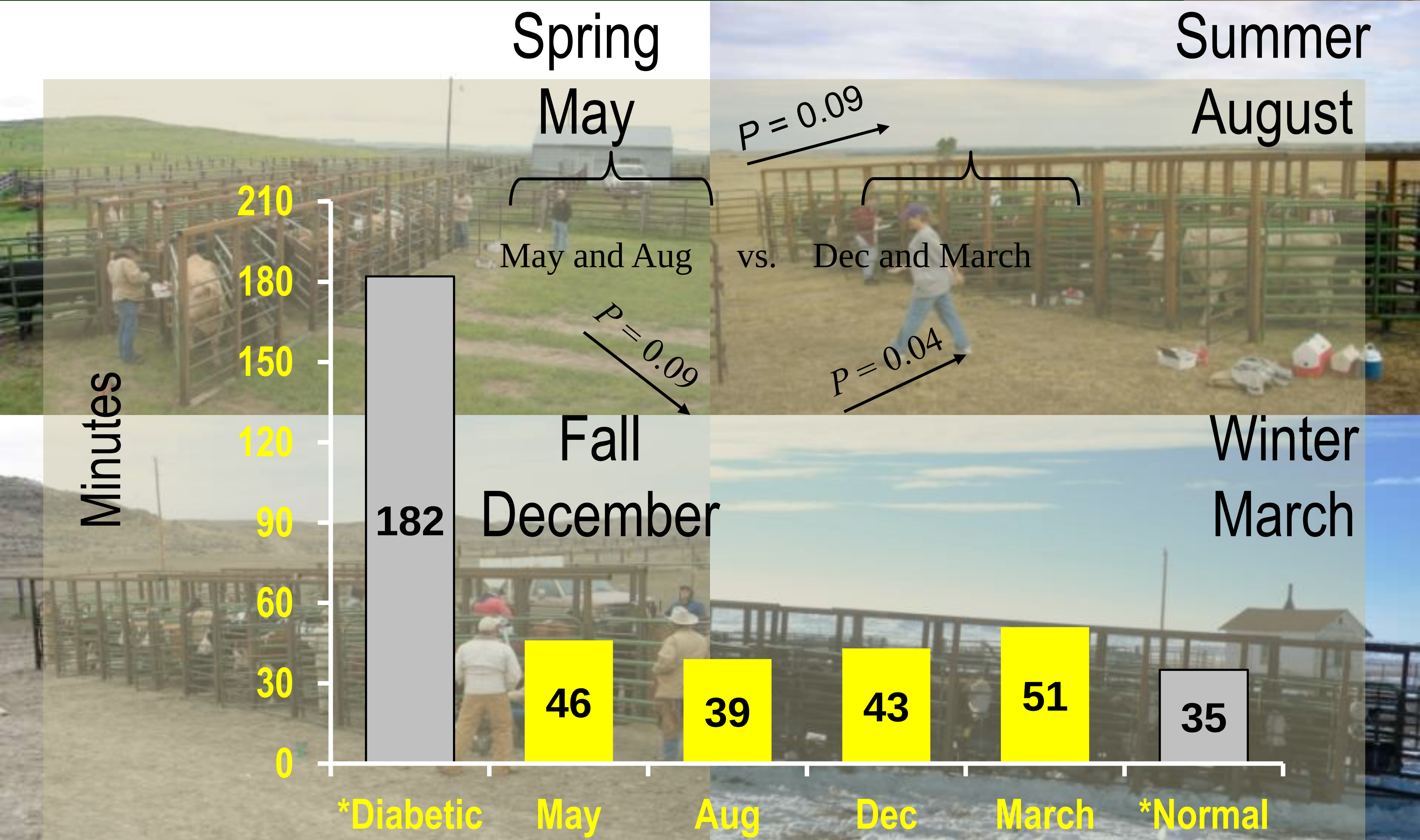


Protein Accretion of N in Gravid Uterine Tissue



Using Eq. 4-10 NRC, 1996

Seasonal Changes in Glucose Half-life



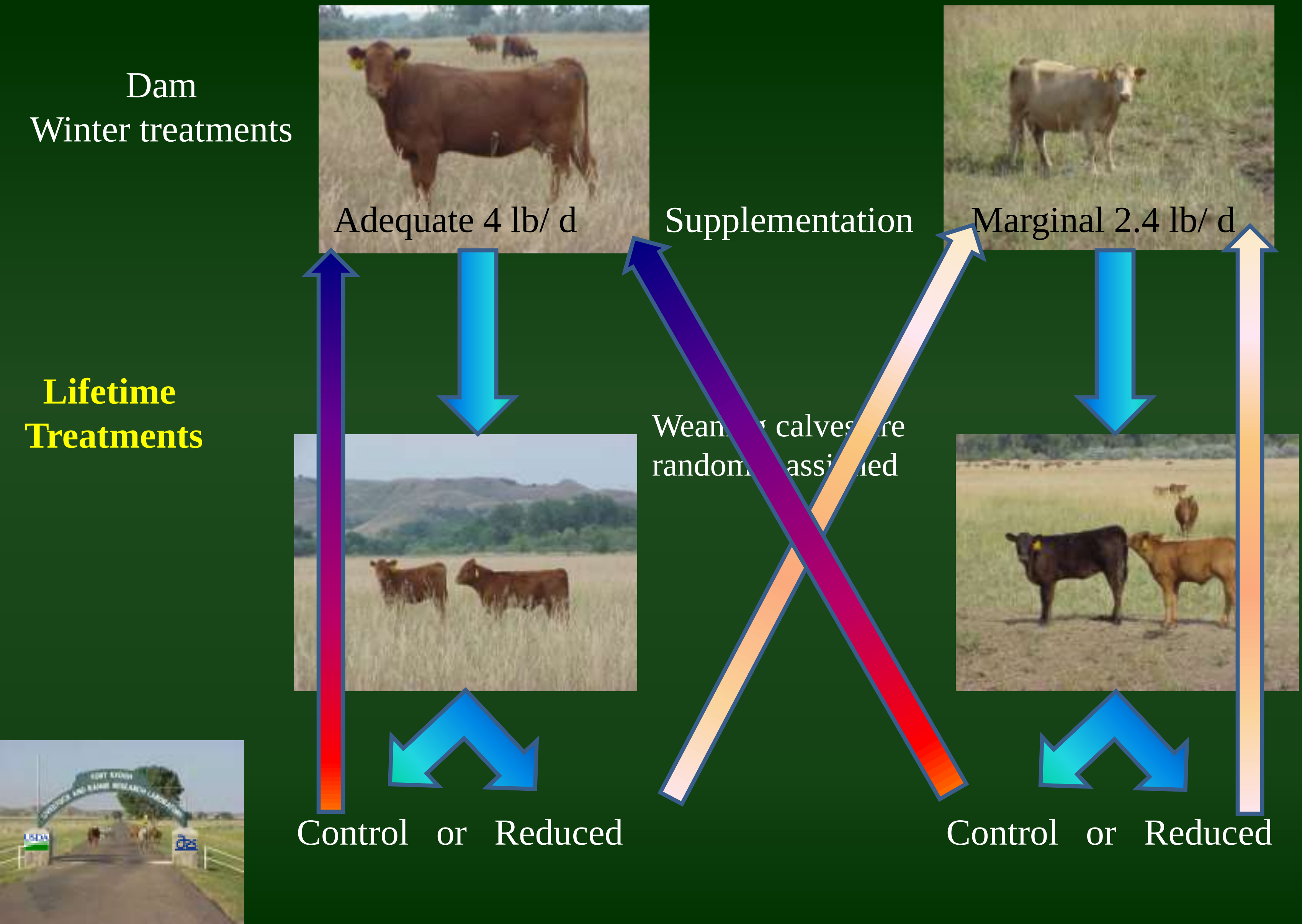
*Kaneko, 1989

Published in Journal of Animal Science 2007

CGC Composite

50% Red Angus, 25% Charolais, 25% Tarentaise

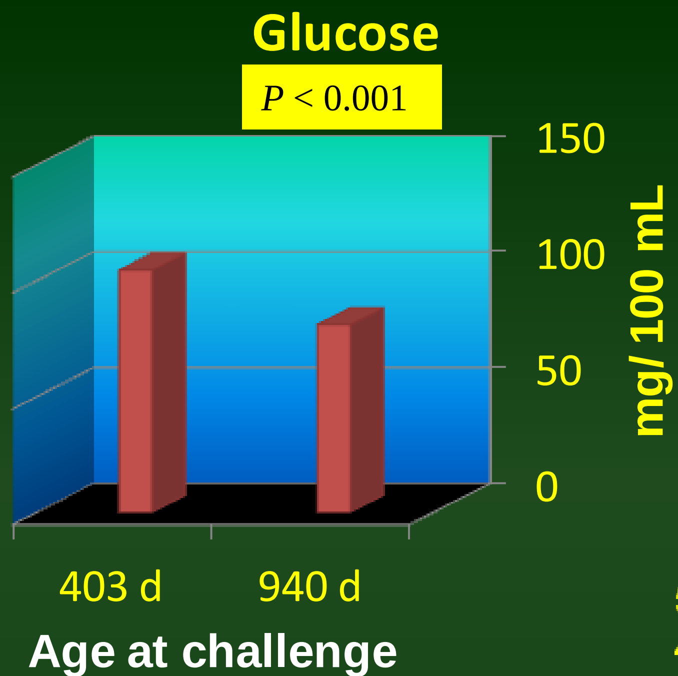
Quick overview of CGC Project

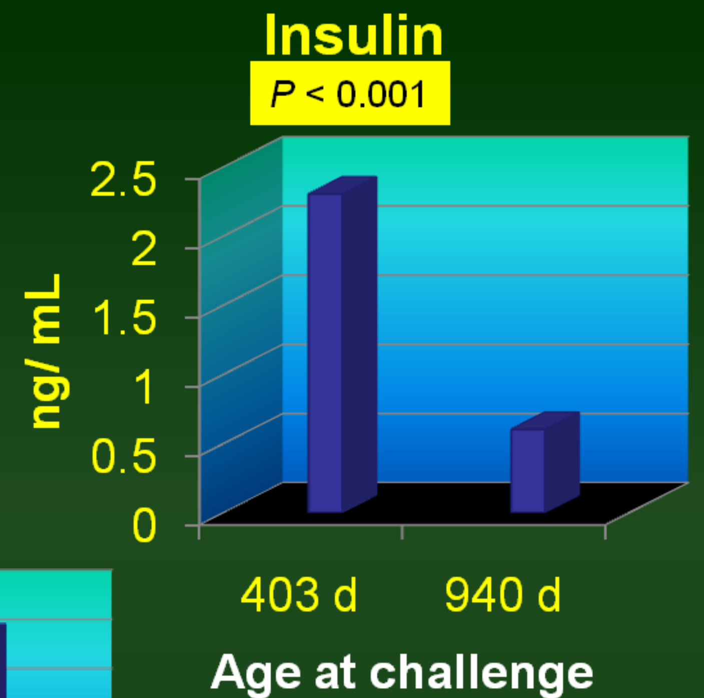


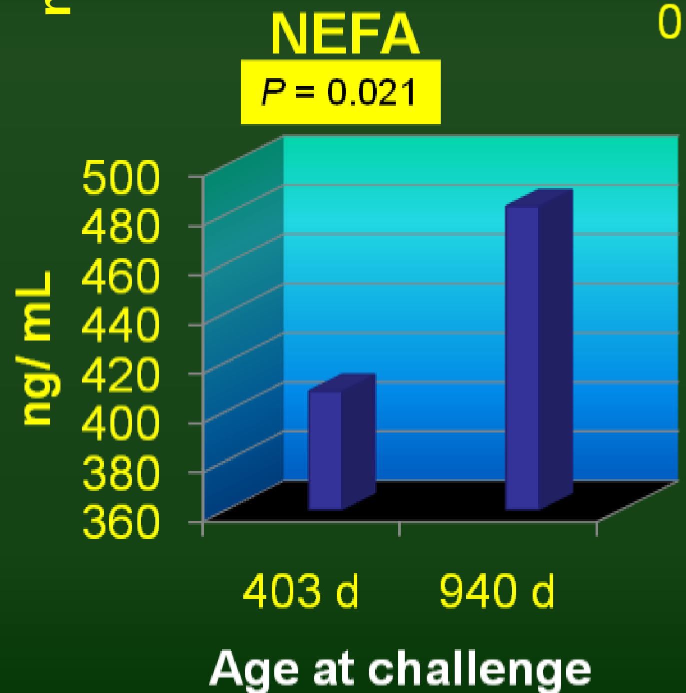
Glucose/ Acetate clearance test

- **At end of heifer development (403 d of age)**
- **Again in Fall when pregnant with second calf (940 d of age)**

Baseline Measurements







Glucose/Acetate half-life

Important Outcome:

- Glucose Half-life
  - Dam treatment: <u>*P* = 0.083</u> (ADEQ vs. MARG)

Fetal Programming 72.9 vs. 54.8 min

Published British Journal of Nutrition 2011

- Impact
  - Reducing feed input by 20%
    - Did not alter how glucose and acetate was taken up by tissues

Summary

- Ruminants rely on Fermentation by-products
- Adding glucogenic precursors to supplements
  - Decreased glucose half life
  - Decreased day to first estrus
- Seasonal changes do occur in glucose uptake by tissues
- Reducing feed inputs by 20% does not alter the heifers ability utilize glucose.

Thank You!


FORT KEOGH
LIVESTOCK AND RANGE RESEARCH LABORATORY
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