

# Alternative Measures of Fertility

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## Time course of early bovine embryo development

| Event   | Day   | % Pregnant |
|---|-------|------------|
| Estrus  | 0     |            |
| Ovulation and fertilization                       | 1     | 95-100     |
| First cell division                               | 2     |            |
| 8-cell stage                                      | 3     |            |
| Migration to uterus                               | 5-6   |            |
| Blastocyst  | 7-8   | 75-80      |
| Hatching  | 9-11  |            |
| Maternal recognition of pregnancy                 | 15-17 | 70-80      |
| Attachment to the uterus                          | 19    |            |
| Placentation                                      | 25    | 65-75      |
| Definitive attachment of the embryo to the uterus | 42    |            |
| Birth   | 285   | 55-70      |

Data adapted from (Shea, 1981; Flechon and Renard, 1978; Peters, 1996; Telford et al., 1990)





# Factor Affecting Embryonic/Fetal Mortality

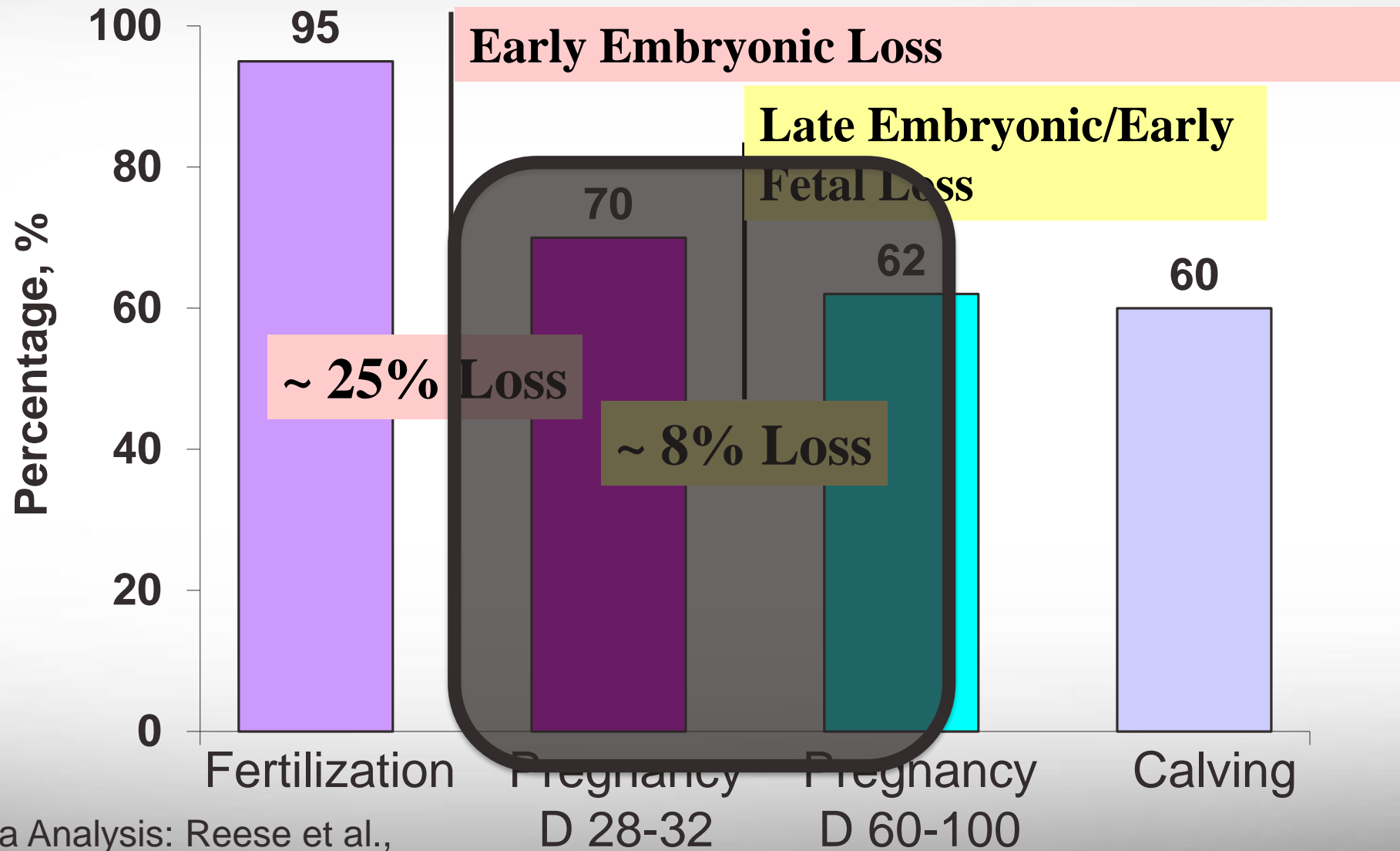
- Genetic factors
- Heat Stress
- Asynchrony between the embryo and maternal environment



# Factor Affecting Embryonic/Fetal Mortality

- Genetic factors
- Heat Stress
- Asynchrony between the embryo and maternal environment
- Effect of the sire
- Nutrition
- Temperament/handling stress

# Fertility of a Single Service



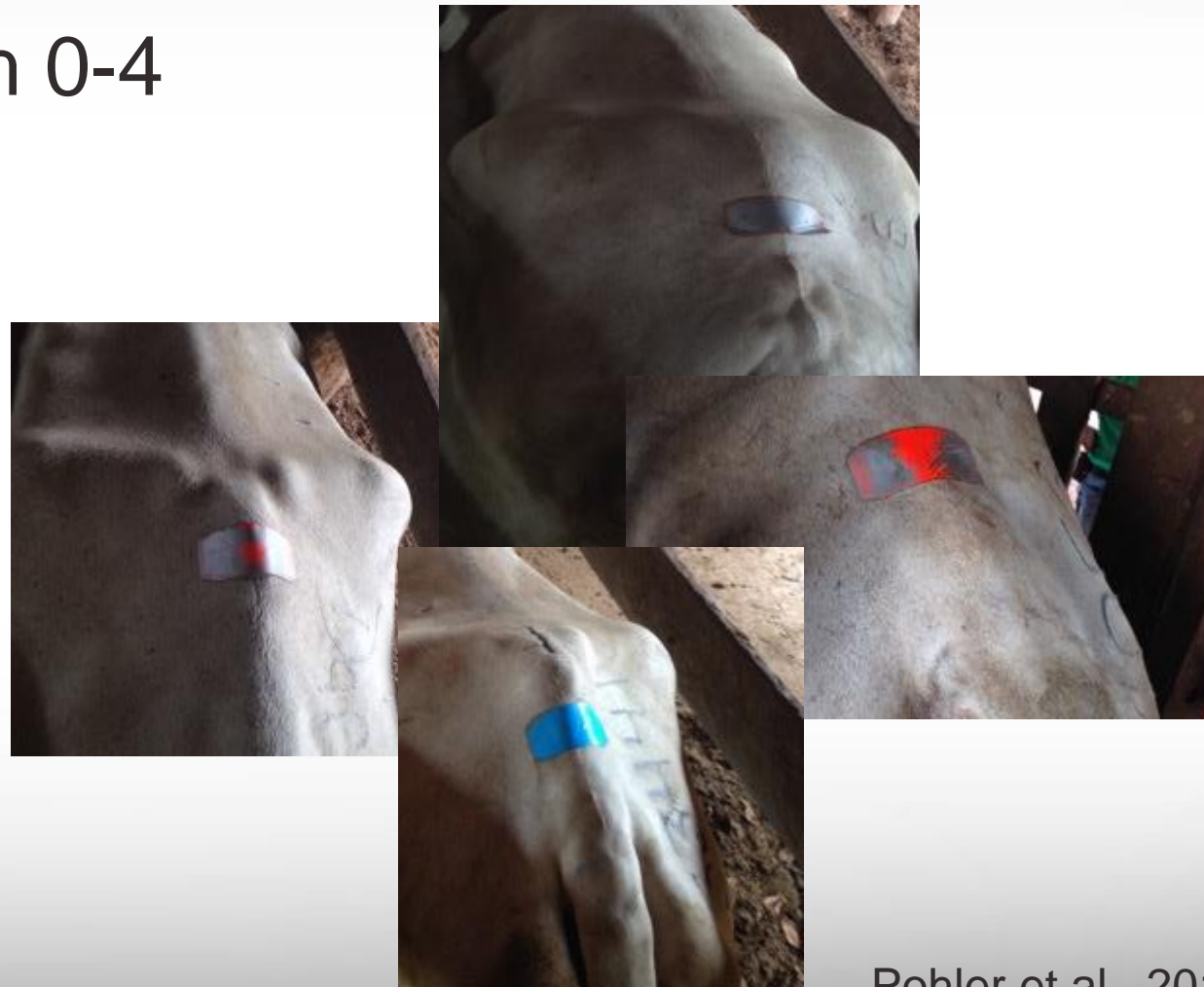
Meta Analysis: Reese et al.,

Submitted



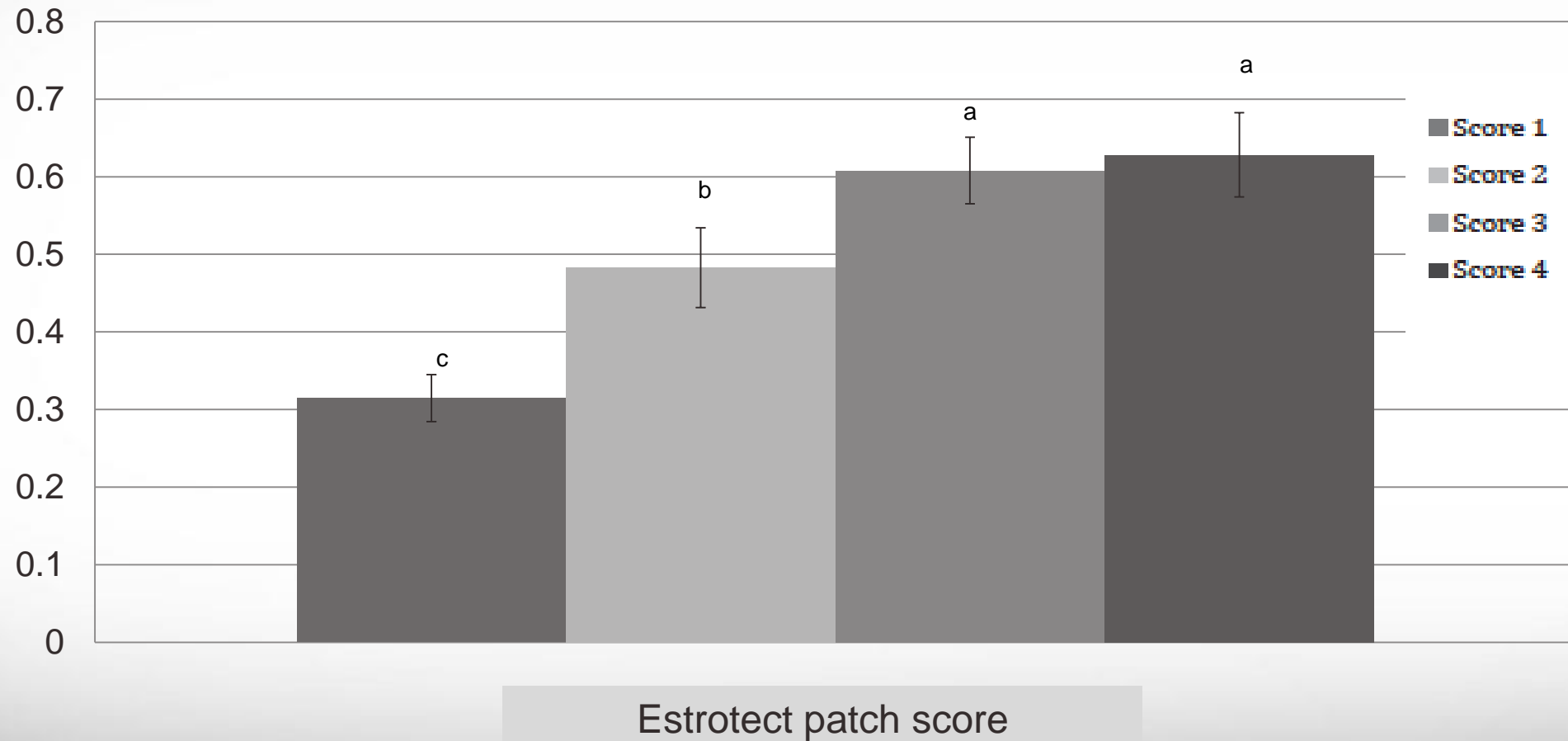
# Scoring the Patches: Estrus before TAI

- Patch scores from 0-4
  - 0 Lost patch
  - 1 < 25%
  - 2 25-50%
  - 3 50-75%
  - 4 >75%



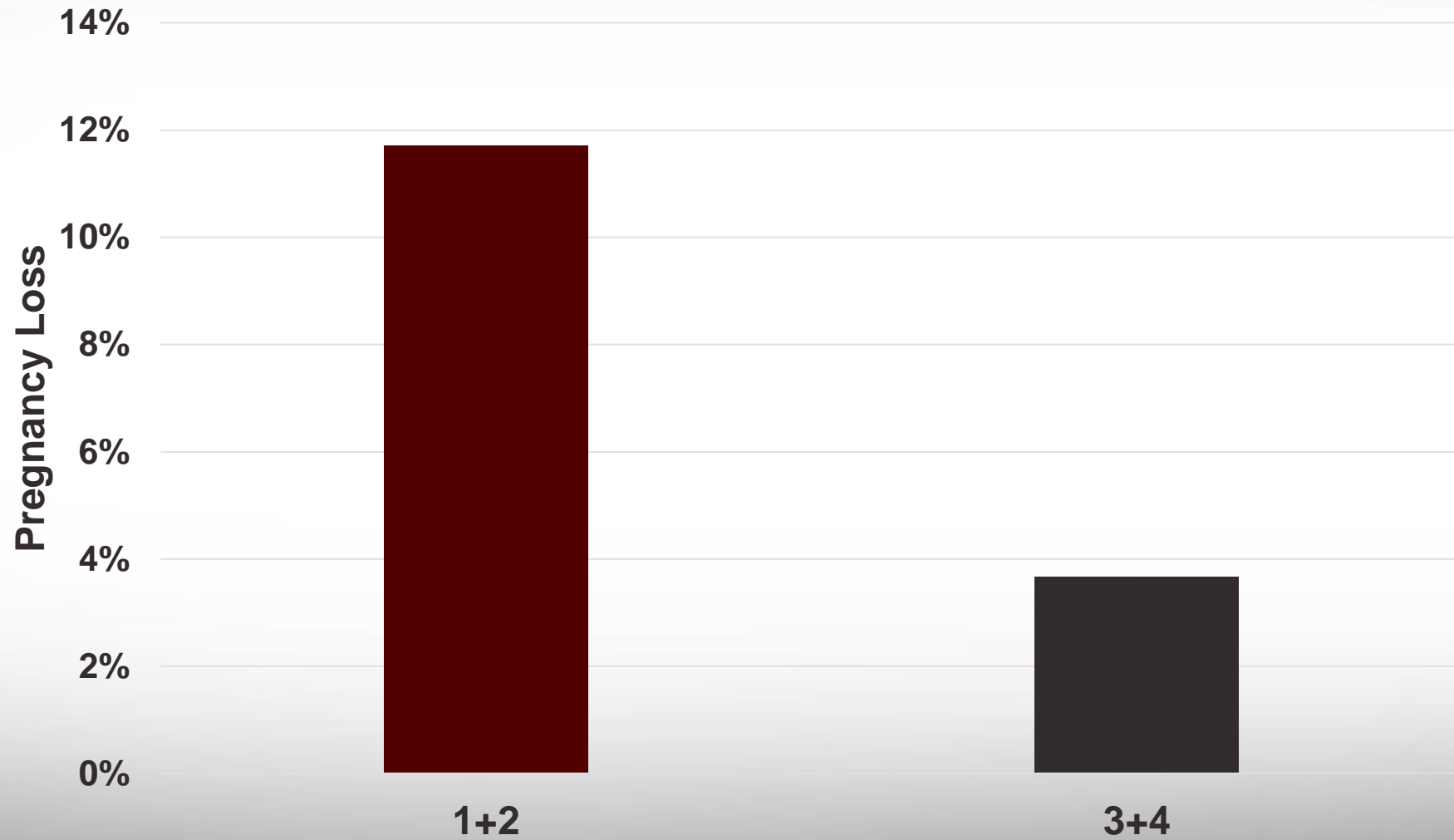
# Estrus and Pregnancy

## Pregnancy rates

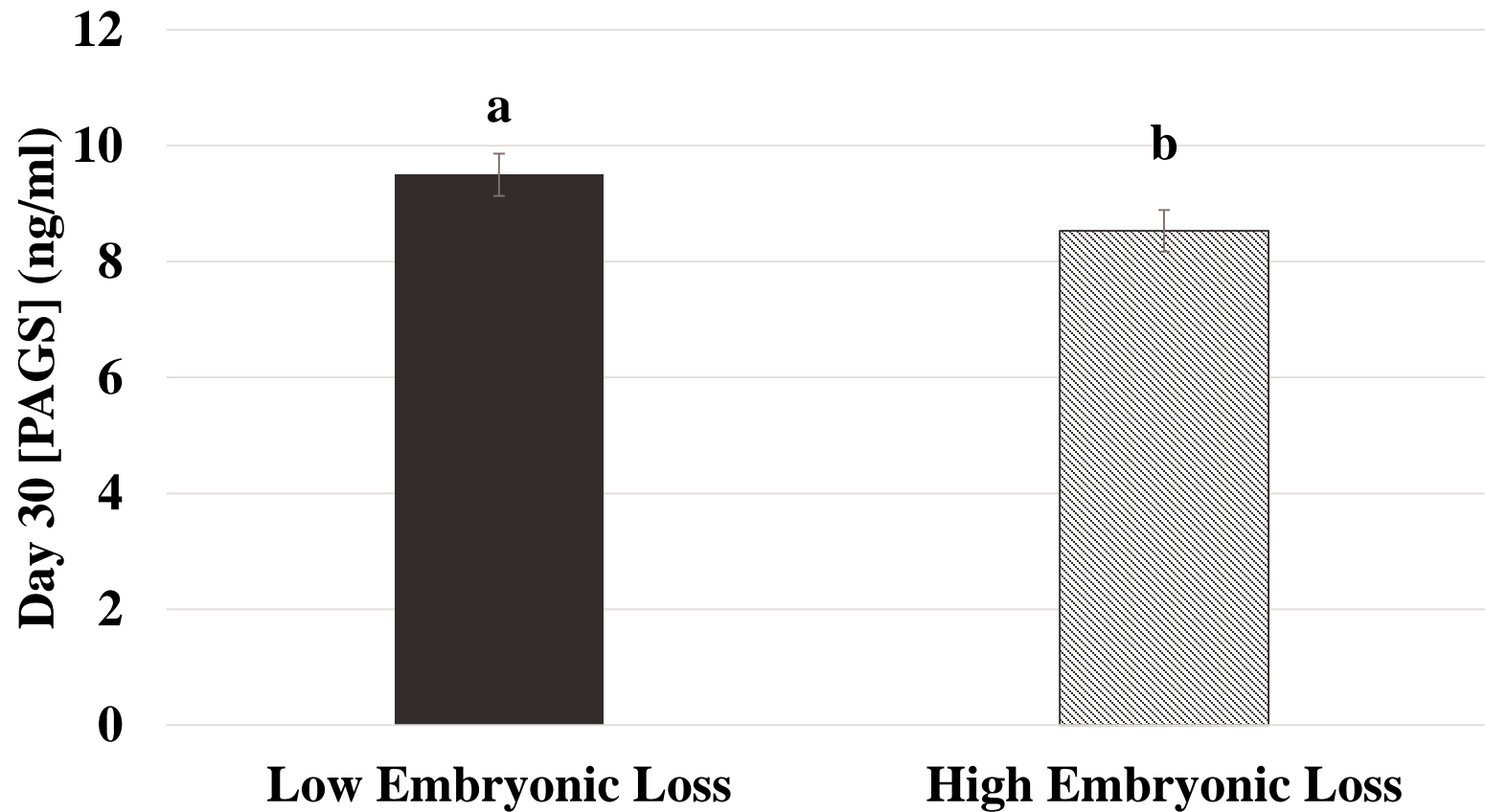




# Pregnancy Loss



# [PAG] by Sire Fertility



# Breed of Sire

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Pregnancy Rate at day 30 (%)

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Nelore x Nelore  $65.53 \pm 3.23^a$

Nelore x Angus  $50.95 \pm 1.57^b$

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# Breed of Sire

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|                 | Pregnancy Rate at day 30 (%) | Late Embryonic Mortality Rate (%) |
|-----------------|------------------------------|-----------------------------------|
| Nelore x Nelore | 65.53±3.23 <sup>a</sup>      | 10.39±1.93 <sup>a</sup>           |
| Nelore x Angus  | 50.95±1.57 <sup>b</sup>      | 4.94±1.07 <sup>b</sup>            |

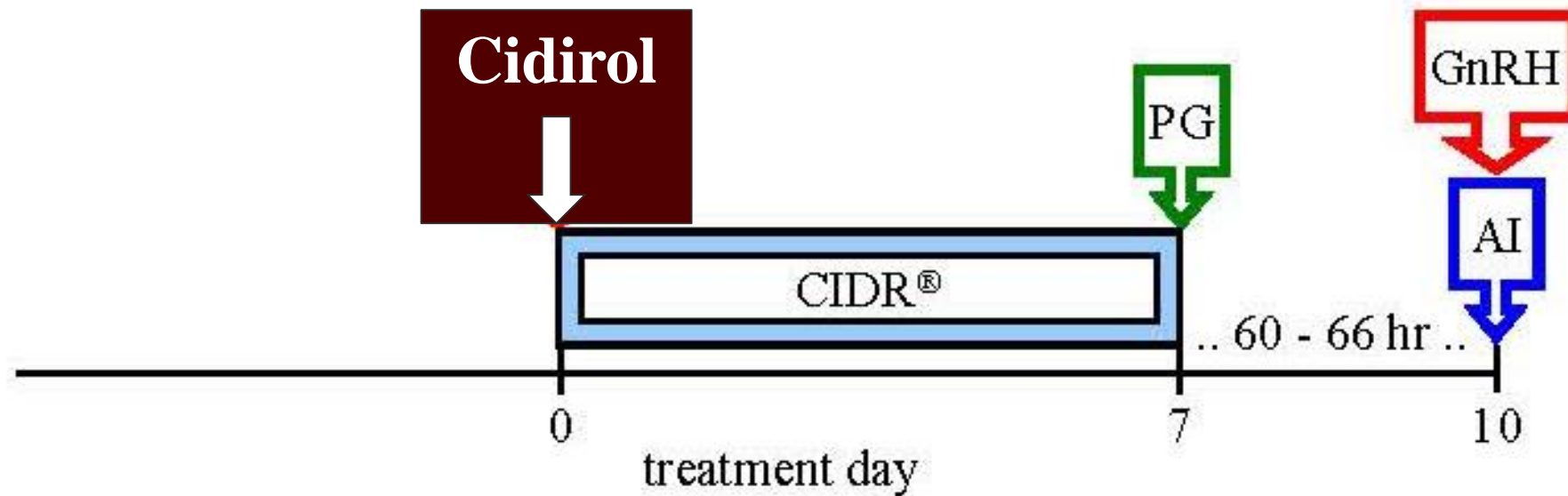
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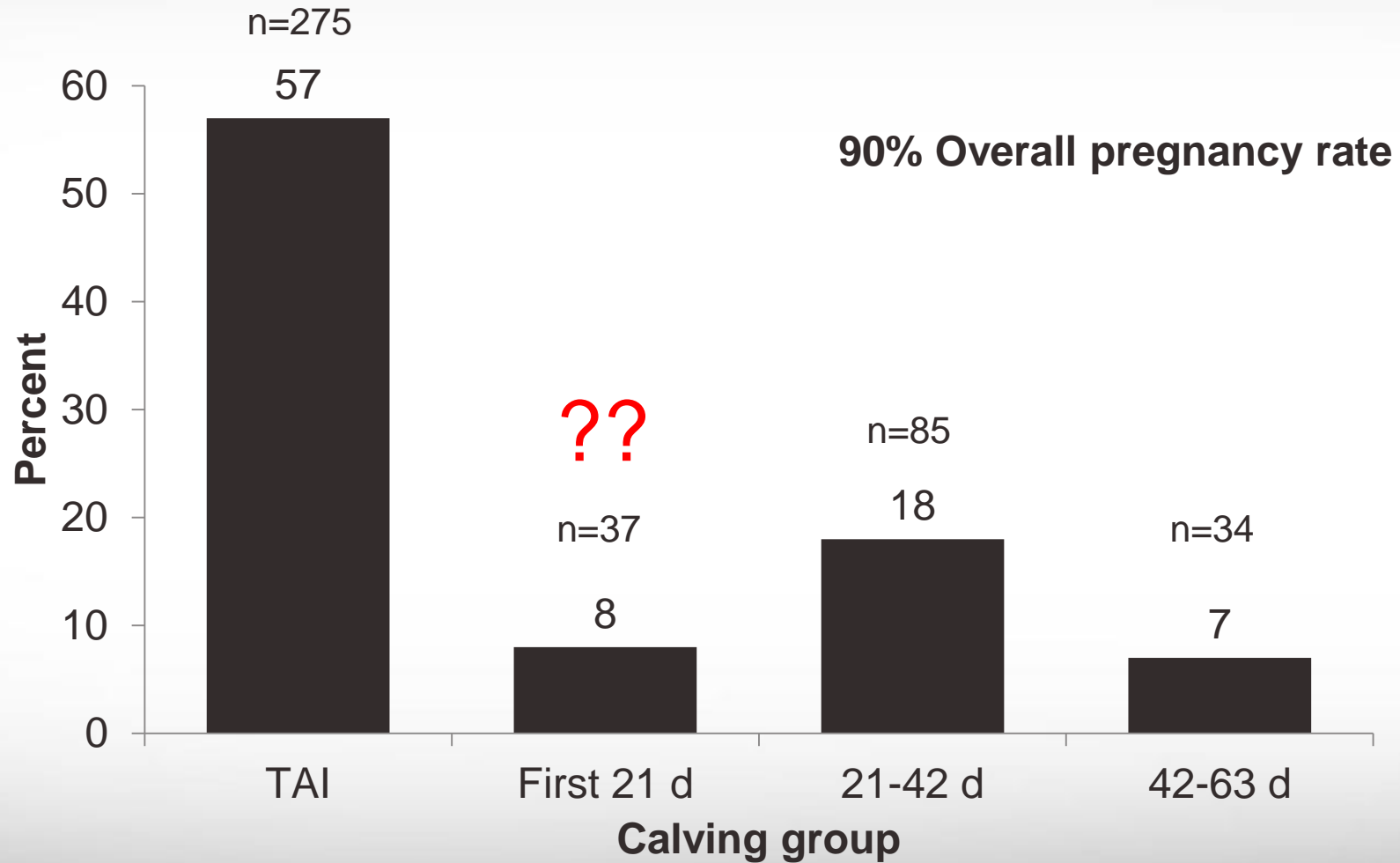
# Estrus Synchronization and AI in Beef Cows

## 7-day CO-Synch + CIDR<sup>®</sup>

Perform TAI at 60 to 66 hr after PG with GnRH at TAI.

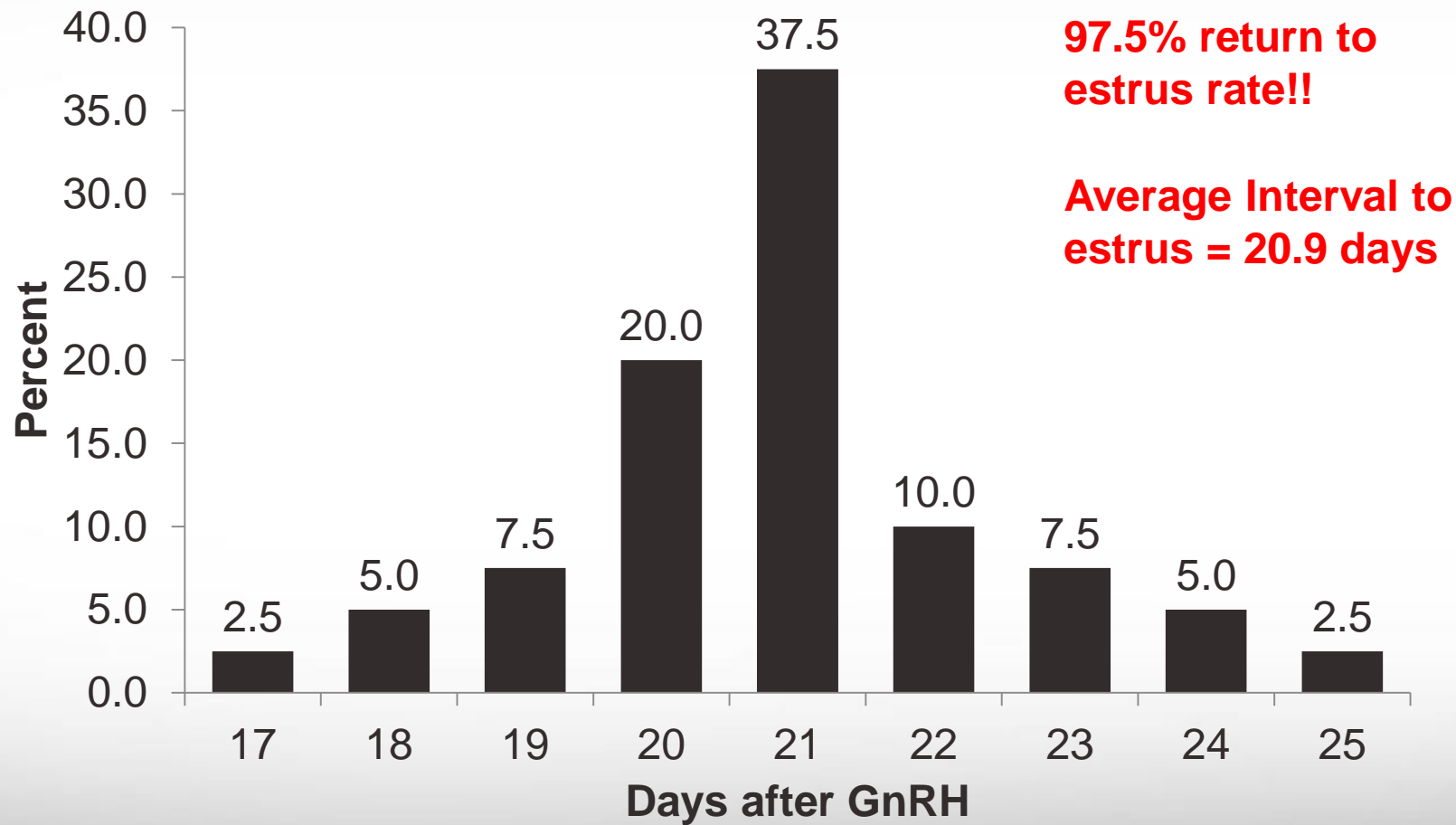


# Does estrus synchronization have a negative impact on subsequent expression on estrus?





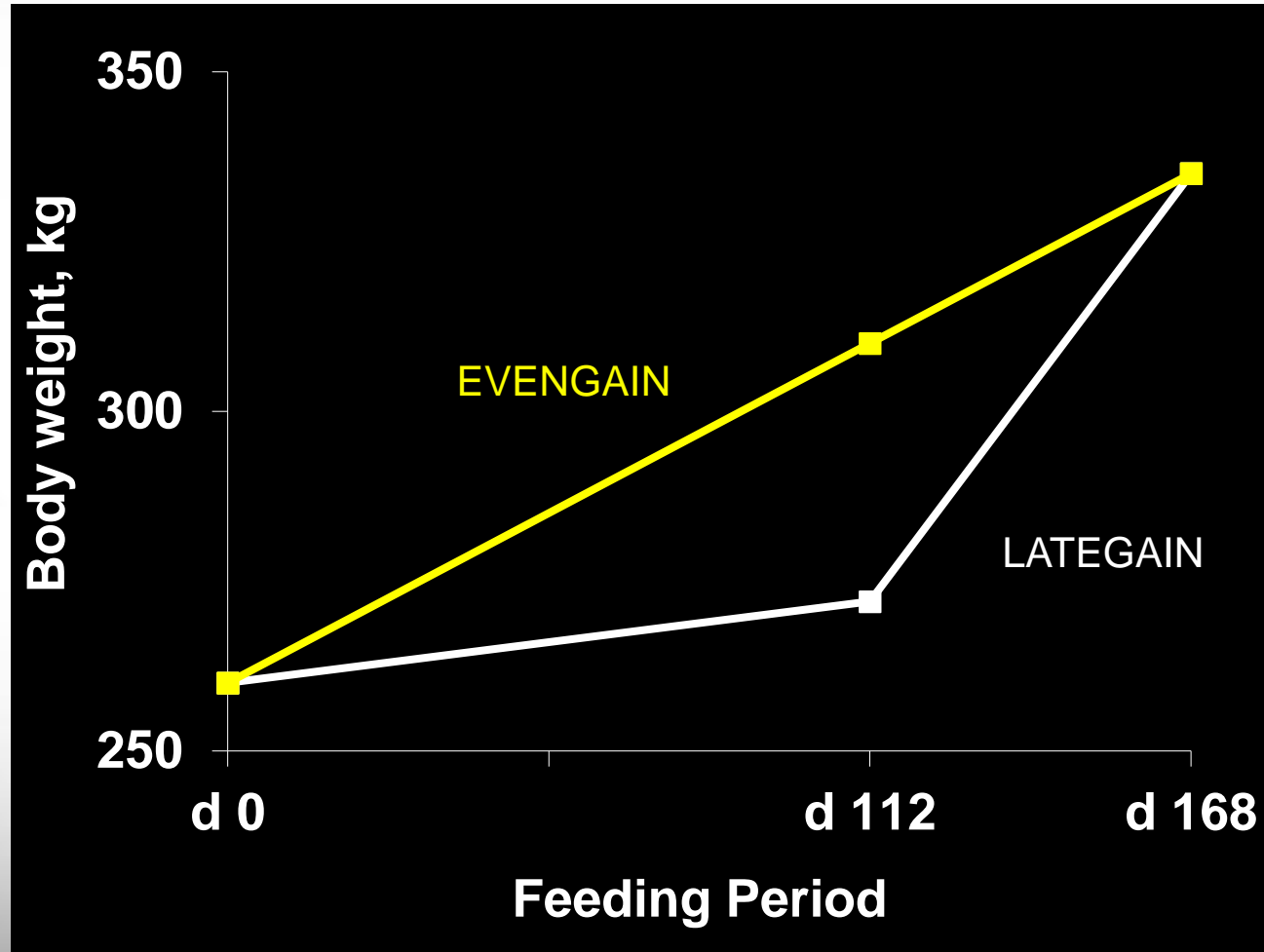
# Estrus response of cows following the 7-day CO-Synch+CIDR protocol



# Effect of timing of gain on attainment of puberty and reproductive performance



# Effect of Timing of Gain on Reproductive Performance



ADG, kg/d d0-112

EVENGAIN - 0.45

LATEGAIN - 0.11

ADG, kg/d d112-168

EVENGAIN - 0.45

LATEGAIN - 0.91

ADG, lbs/d d0-168

EVENGAIN - 0.45

LATEGAIN - 0.45

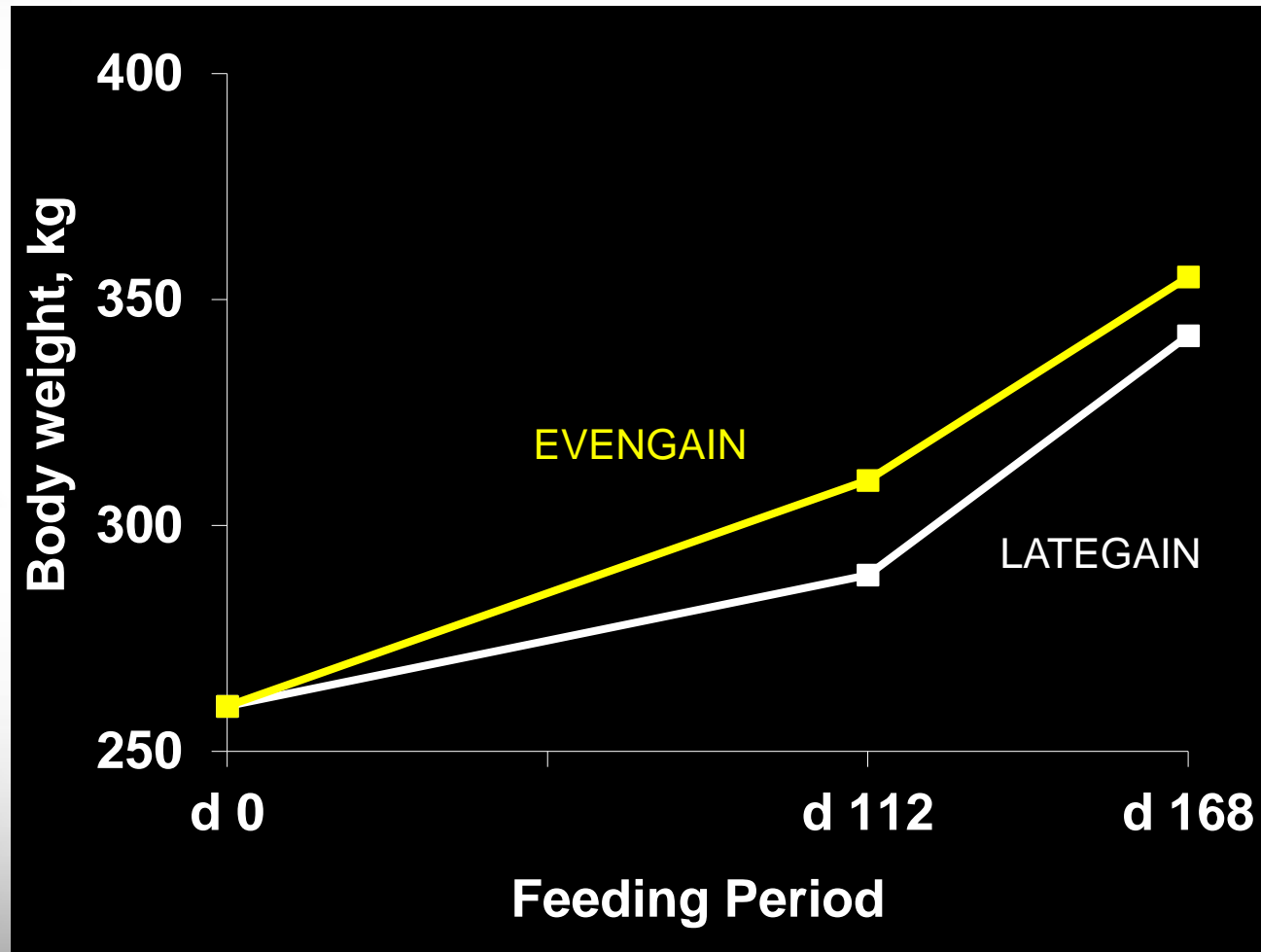
(Lynch et al., 1997)





# Effect of Timing of Gain on Reproductive Performance

Year 1



ADG, kg/d d0-112

EVENGAIN - 0.45

LATEGAIN - 0.26

ADG, kg/d d112-168

EVENGAIN - 0.80

LATEGAIN - 0.95

ADG, lbs/d d0-168

EVENGAIN - 0.57

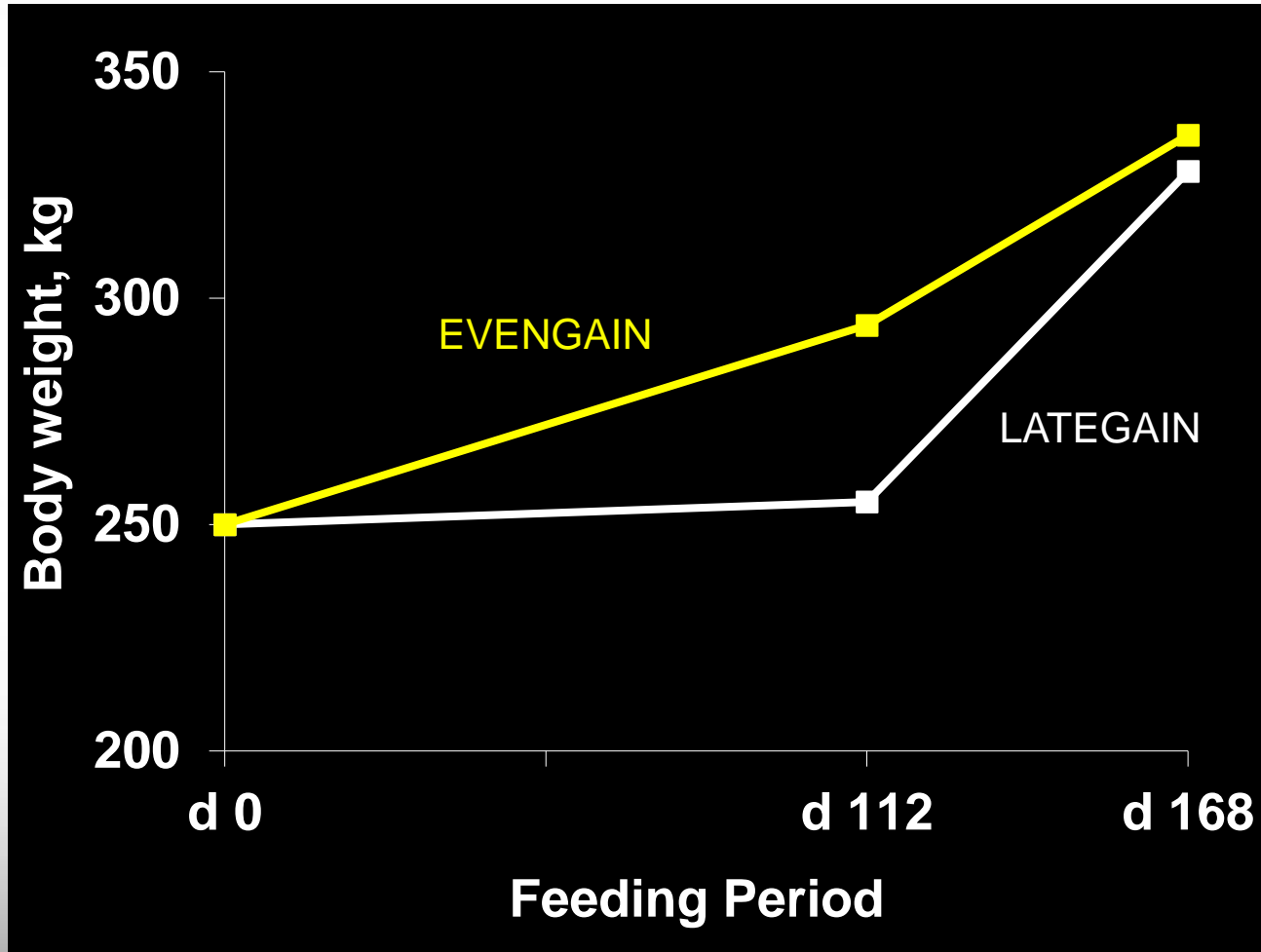
LATEGAIN - 0.49

(Lynch et al., 1997)



# Effect of Timing of Gain on Reproductive Performance

Year 2



ADG, kg/d d0-112

EVENGAIN - 0.39

LATEGAIN - 0.05

ADG, kg/d d112-168

EVENGAIN - 0.74

LATEGAIN - 1.30

ADG, lbs/d d0-168

EVENGAIN - 0.53

LATEGAIN - 0.50

(Lynch et al., 1997)



# Effect of Timing of Gain on Reproductive Performance

| <b>Item</b>                  | <b>EVENGAIN</b>  | <b>LATEGAIN</b>  |
|------------------------------|------------------|------------------|
| <b>Age at puberty, d</b>     |                  |                  |
| Year 1                       | 388              | 384              |
| Year 2                       | 386 <sup>a</sup> | 407 <sup>b</sup> |
| <b>Weight at puberty, kg</b> |                  |                  |
| Year 1                       | 330              | 315              |
| Year 2                       | 314              | 314              |

<sup>ab</sup> Means within row differ (P < 0.01)

(Lynch et al., 1997)



# Effect of Timing of Gain on Reproductive Performance

| Item                       | EVENGAIN | LATEGAIN |
|----------------------------|----------|----------|
| <b>First service PR, %</b> |          |          |
| Year 1                     | 55.3     | 55.5     |
| Year 2                     | 56.4     | 71.1     |
| <b>Overall PR, %</b>       |          |          |
| Year 1                     | 87.2     | 86.8     |
| Year 2                     | 87.5     | 87.5     |

(Lynch et al., 1997)

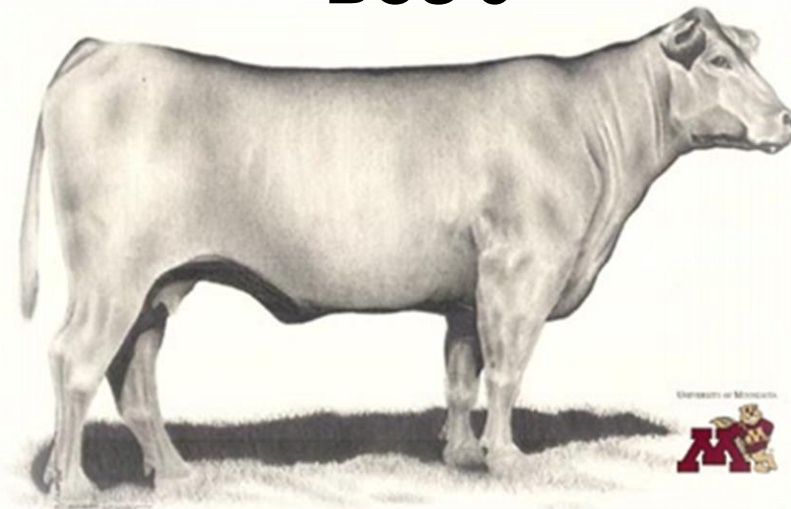




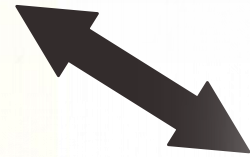
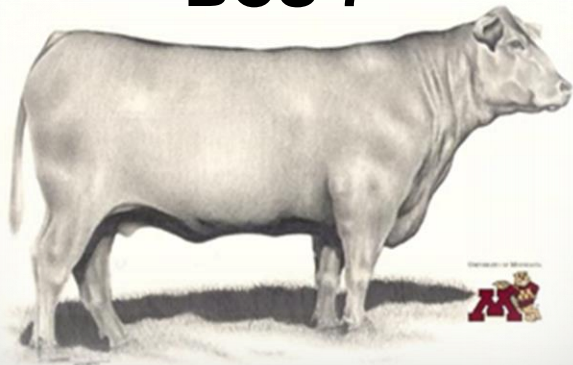
**BCS 3**



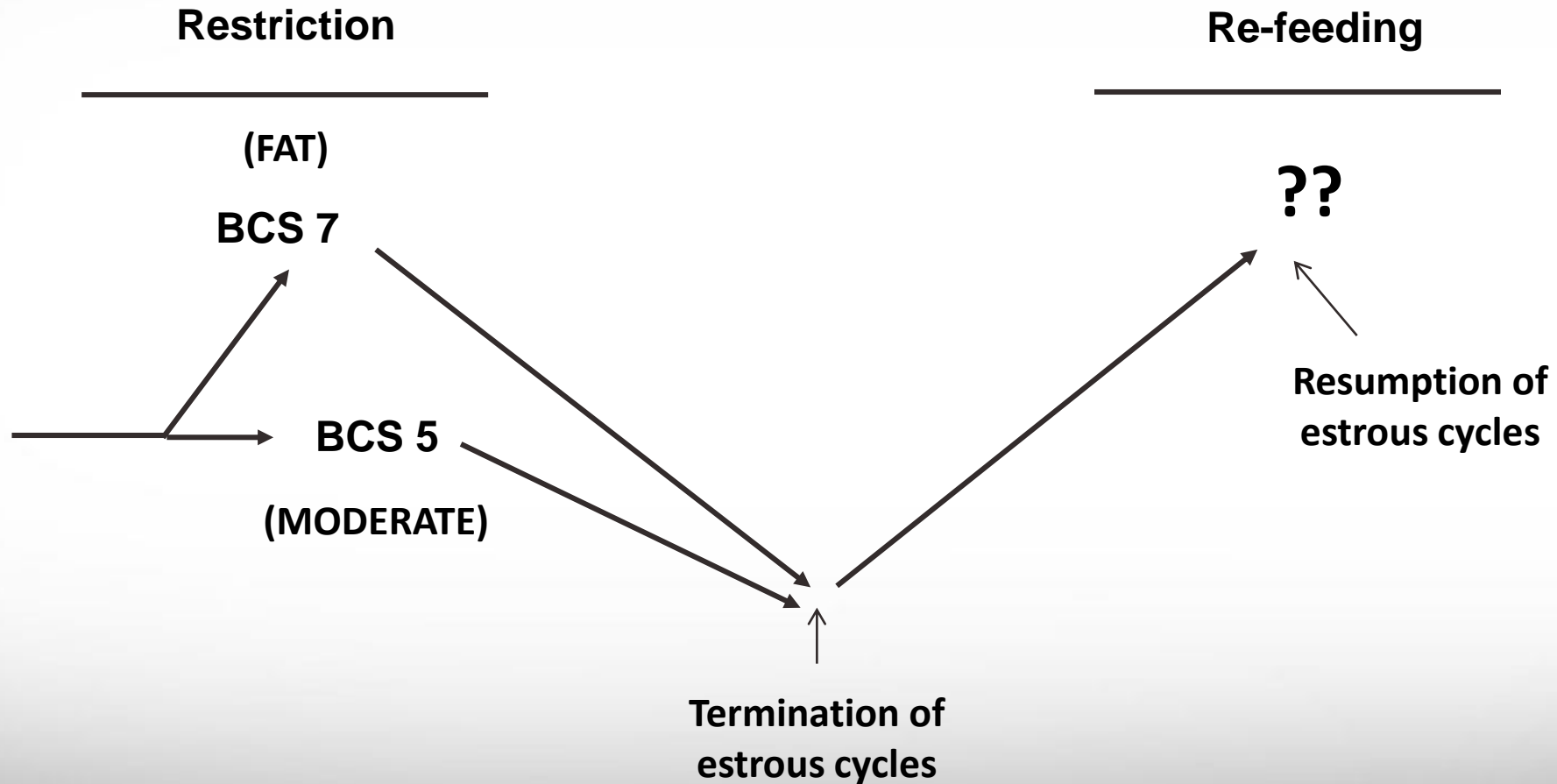
**BCS 5**



**BCS 7**



# Impact of Change in BCS on Reproduction in Heifers



# Impact of Change in BCS on Reproduction in Heifers

## Treatments

| Item               | MODERATE          | FAT                |
|--------------------|-------------------|--------------------|
| Initial BW, kg     | 425 <sup>a</sup>  | 515 <sup>b</sup>   |
| Initial BCS        | 5.0 <sup>a</sup>  | 7.1 <sup>b</sup>   |
| BW at anestrus, kg | 354               | 380                |
| BCS at anestrus    | 3.1               | 3.3                |
| Days to anestrus   | 66.5 <sup>a</sup> | 155.9 <sup>b</sup> |



# Impact of Change in BCS on Reproduction in Heifers

| Item                                    | Treatments       |                  |
|---|------------------|------------------|
|   | MODERATE         | FAT              |
| BW at anestrus, kg                      | 354              | 380              |
| BCS at anestrus                         | 3.1              | 3.3              |
| BW at 1 <sup>st</sup> estrous cycle, kg | 455 <sup>a</sup> | 513 <sup>b</sup> |
| BCS at 1 <sup>st</sup> estrous cycle    | 5.2 <sup>a</sup> | 6.0 <sup>b</sup> |
| Days to 1 <sup>st</sup> estrous cycle   | 67.7             | 78.9             |





Ruler

Line Path

Length: 0.90 Kilometers

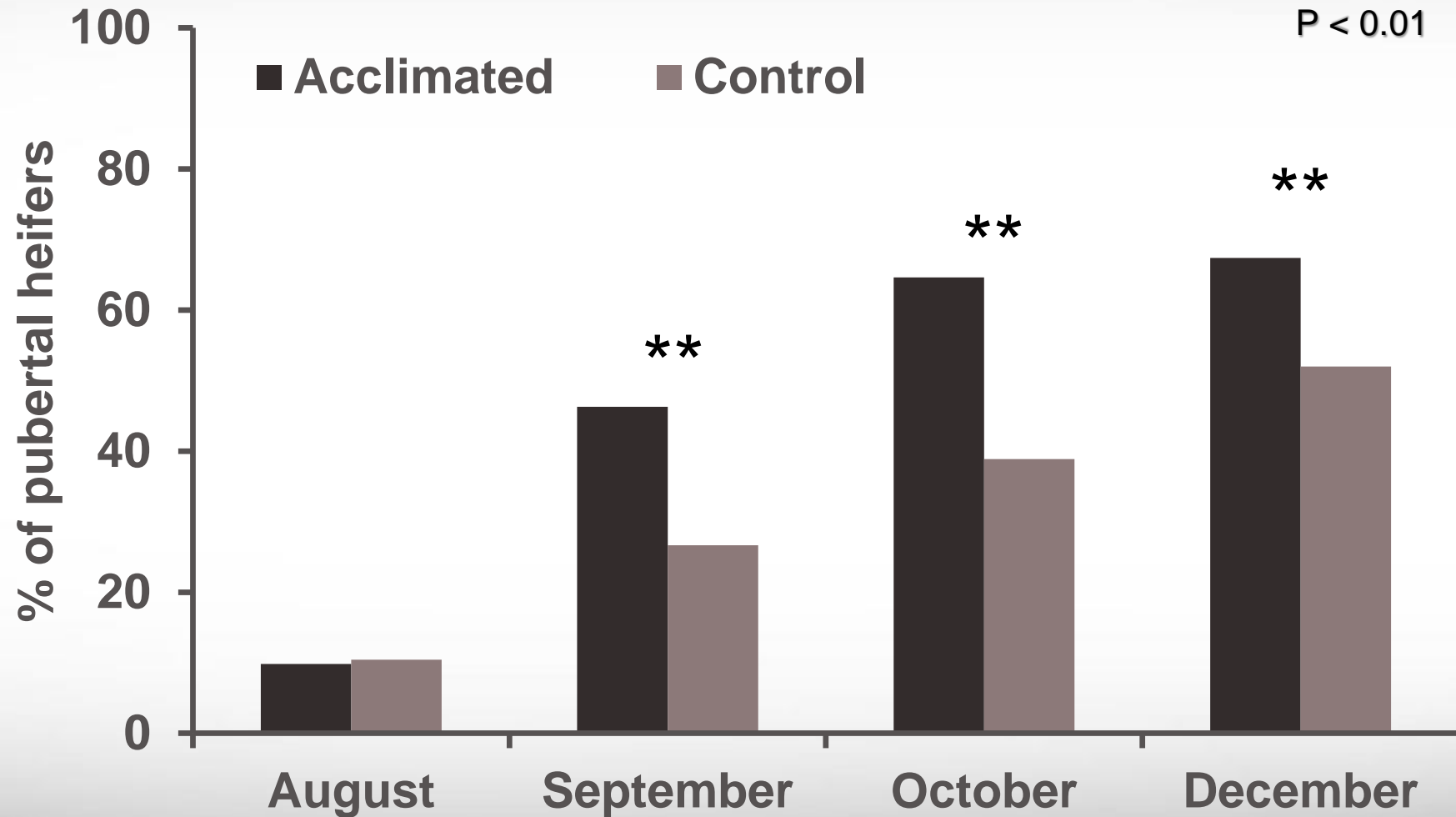
Mouse Navigation

Clear

Pointer 27°23'32.61" N 81°56'16.24" W elev



# Acclimation of Heifers



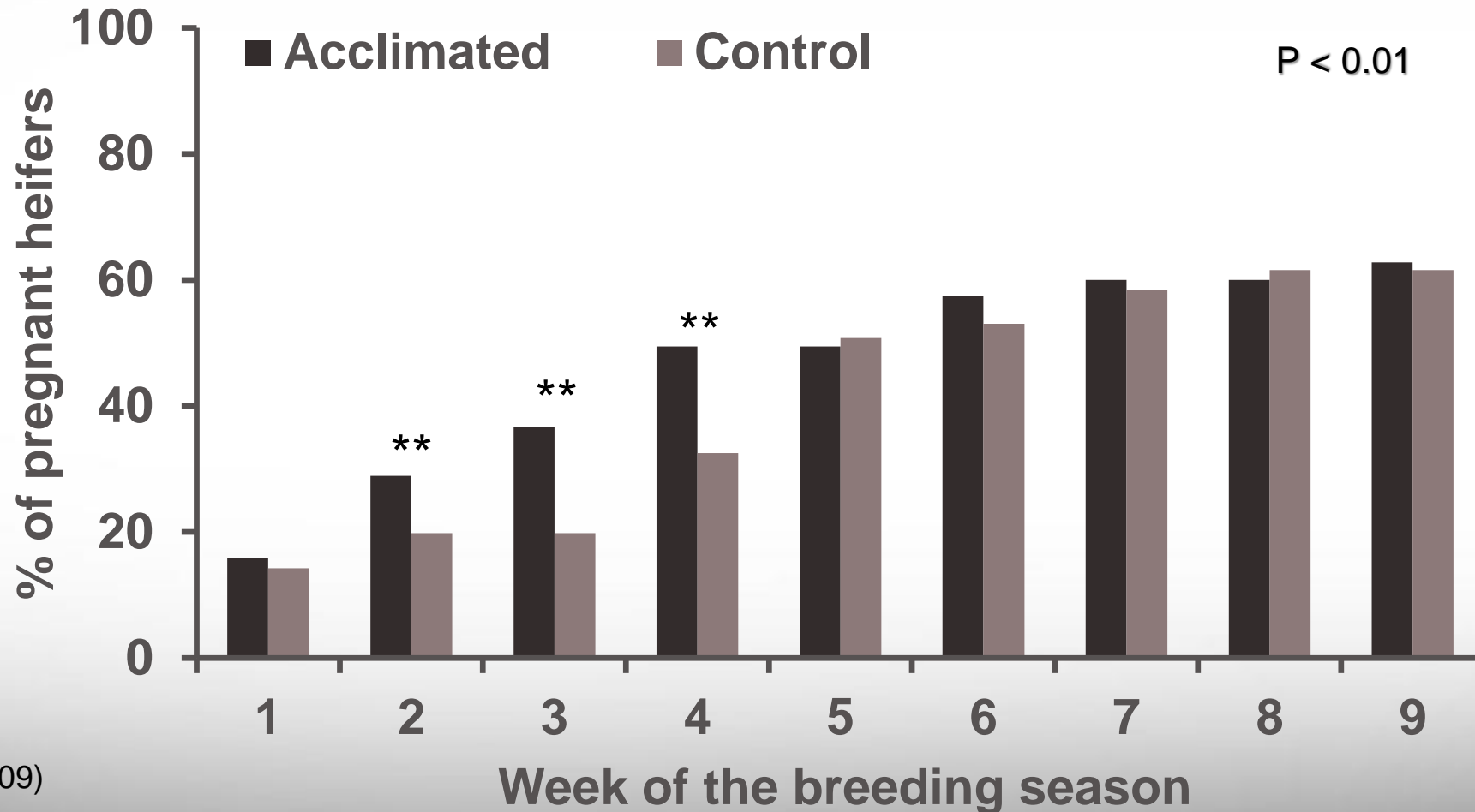
Cooke et al. (2009)





# Acclimation of Heifers

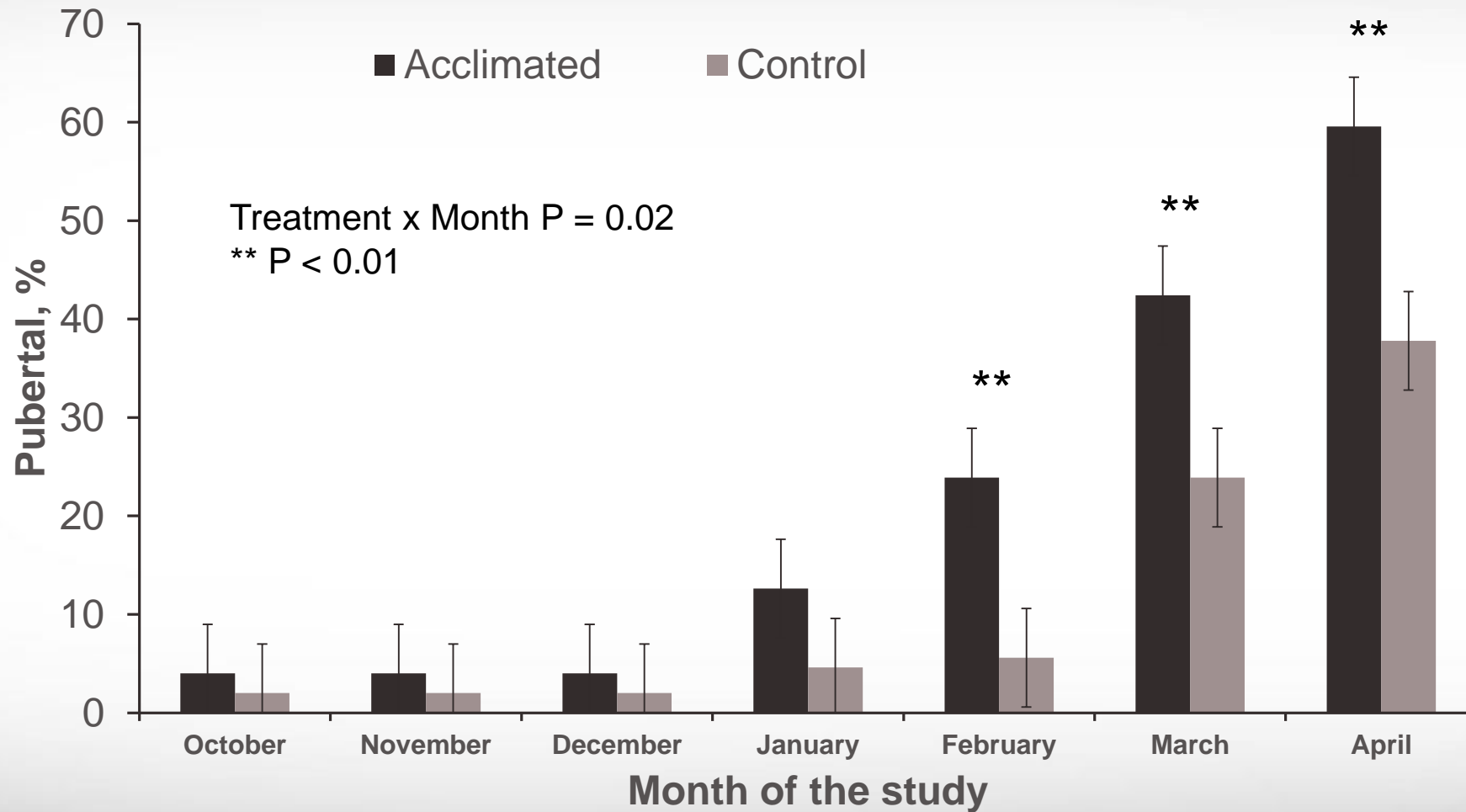
- Pregnancy during the breeding season







# Acclimation of Heifers



# Beef Cattle Production

## *Cow-calf segment: Gestational nutrition*

- **Last trimester of gestation**
  - Availability of cows for feeding/replication
  - Specific nutrients associated with fetal development
    - Practical strategies for beef producers



| Item               | CON  | INR  | ORG  | Required |
|--------------------|------|------|------|----------|
| Maternal diet (DM) | -    | Sulf | Av-4 |          |
| TDN, %             | 61   | 61   | 61   | 53       |
| CP, %              | 14.4 | 14.4 | 14.4 | 7.8      |
| Co, ppm            | 1.03 | 2.18 | 2.14 | 0.10     |
| Cu, ppm            | 10.3 | 20.8 | 20.6 | 10       |
| Mn, ppm            | 55.9 | 74.0 | 74.3 | 40       |
| Zn, ppm            | 30.6 | 63.9 | 63.7 | 30       |

# Beef Cattle Production

## *Cow-calf segment: Gestational nutrition*

- **Last trimester of gestation**
  - Availability of cows for feeding/replication
  - Specific nutrients associated with fetal development
    - Practical strategies for beef producers

| Item           | CON               | INR                | ORG               | P =    |
|----------------|-------------------|--------------------|-------------------|--------|
| Cobalt, ppm    |                   |                    |                   |        |
| Cotyledon      | 0.13 <sup>a</sup> | 0.20 <sup>b</sup>  | 0.24 <sup>b</sup> | 0.02   |
| Calf liver     | 0.09 <sup>a</sup> | 0.12 <sup>b</sup>  | 0.13 <sup>b</sup> | < 0.01 |
| Copper, ppm    |                   |                    |                   |        |
| Cotyledon      | 3.88 <sup>a</sup> | 4.75 <sup>ab</sup> | 5.11 <sup>b</sup> | 0.10   |
| Calf liver     | 362 <sup>a</sup>  | 428 <sup>ab</sup>  | 450 <sup>b</sup>  | 0.18   |
| Manganese, ppm |                   |                    |                   |        |
| Cotyledon      | 22.0              | 18.2               | 22.9              | 0.73   |
| Calf liver     | 5.82              | 5.22               | 5.83              | 0.43   |
| Zinc, ppm      |                   |                    |                   |        |
| Cotyledon      | 65                | 66                 | 68                | 0.87   |
| Calf liver     | 456 <sup>a</sup>  | 562 <sup>ab</sup>  | 660 <sup>b</sup>  | 0.01   |

| Item            | CON               | INR               | ORG               | P =  |
|-----------------|-------------------|-------------------|-------------------|------|
| Calving results |                   |                   |                   |      |
| Birth BW        | 42.1              | 41.6              | 40.8              | 0.63 |
| Weaning results |                   |                   |                   |      |
| Weaning BW, kg  | 212 <sup>a</sup>  | 223 <sup>ab</sup> | 236 <sup>b</sup>  | 0.04 |
| Feedyard        |                   |                   |                   |      |
| BRD symptoms, % | 42.3 <sup>a</sup> | 59.1 <sup>a</sup> | 20.0 <sup>b</sup> | 0.02 |
| ADG, kg/d       | 1.69              | 1.71              | 1.74              | 0.66 |
| Carcass         |                   |                   |                   |      |
| HCW, kg         | 409 <sup>a</sup>  | 418 <sup>ab</sup> | 428 <sup>b</sup>  | 0.10 |





# Beef Cattle Production

## *Cow-calf segment: Gestational nutrition*

- **Last trimester of gestation**
  - Availability of cows for feeding/replication
  - Specific nutrients associated with fetal development
    - Practical strategies for beef producers



| Item                   | CON      | PUFA      | Required |
|------------------------|----------|-----------|----------|
| Maternal diet (DM)     | Palm oil | SB + Fish |          |
| TDN, %                 | 61       | 61        | 53       |
| CP, %                  | 10.2     | 10.2      | 7.8      |
| Fatty acids, %         | 3.52     | 3.49      | ???      |
| Linoleic (18:2 n-6), % | 0.44     | 0.69      | ???      |
| EPA (20:5 n-3), %      | 0.00     | 0.13      | ???      |
| DHA (22:6 n-3), %      | 0.00     | 0.11      | ???      |



# Acknowledgements



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