Pre-fresh Heifers

A Might not Equal B

VITA PLUS Calf Summit 2018

Pre-fresh Heifers…… Common A = B allegories

Udder edema = dietary salt

Transition (pre-fresh) = 21 d

Over-conditioned pre-fresh heifers = excess corn silage

Early calving = increased profits

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Gestation Length (GL)

- Holstein (Norman et al., 2009)
  - Heifers (277.8 ± 5.5 d)
  - Cows (279.4 ± 5.7 d)
- Factors influencing GL
  - Genetics, calf gender, twin, age of dam, and season of year.
- Short or long GL increased incidence of stillbirth, and dystocia (Nogalski and Piwczyński, 2012).

Courtesy of Dr. Noah Litherland

Two California dairies (3,335 Primi- and 4,909 Multiparous cows) Impact of gestation length

	Average	Short	Long	P-value
Mean gestation, d	276	266	285	
Range, d	270 to 282	256 to 269	283 to 296	
Milk production, lb./d	84.8	80.7	83.0	< 0.01 (SEM = 0.67)

	Primiparous			Multiparous		
Item	Average	Short	Long	Average	Short	Long
Cow #	3,725	475	311	2,546	287	841
Cow, %	82.6	10.5	6.9	69.3	7.8	22.9

Courtesy of Dr. Noah Litherland

Vieira-Neto et al., 2017

Dam/daughter interactions impact GL

- 1st lactation cows have less body capacity so space limitations can create fetal stress and early parturition.
- Similarly, cows calving in heat stress have shorter gestation periods than cows calving in cool season.
  - Evaporatively cooled late gestation cows had GL 3.5 d longer than cows not receiving cooling (Tao and Dahl, 2014).
- It is possible heat stress promotes maturation of the HPA-axis and shorter GL. (Vieira-Neto et al., 2017)

Courtesy of Dr. Noah Litherland

What gestation length do we use? 279?

- Heifer Calves (Sexed Semen) - 1.7 d
- Heat Stress – 3.5 d
- GL PTA Service Sires - 1-3 d
- Calving Ease Sires – 2 d
- Days in Pre-fresh Pen (21 d could equal 11 days)

Prepartum Management by Herd Size

	Description	<1,000 cows	>1,000 cows
Heifers	Age 1st calving, mo.	23.6	22.7
Dry cow	Days dry	54.9	54
	Dry cow stocking density %	161.8	104.2
	Hygiene score	1.2	1
	# pen moves dry off - calving	2.6	3.1

Number of Pen Moves from Dry off to Calving

Average: 2.86

High: 5 (2 farms)

Low: 1 (1 farm)

Herd Adaptation – Pre-fresh Heifers

- Disease Exposure (Older Cows)
- Feed/Water/Resting Adaptation 3-5 days
- Social Adaptation 5-7 days
- Parlor and Travel Adaptation 2-3 days
- Oxidative Stress (Maybe Heifers Need More Time – 28d?)
  (Maybe less moves?)

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Lets look at where "They say" comes from

Journal of Dairy Science : 1988

- **4 Treatments (11 Heifers/Trt)**

A= No Salt
B= 4 oz of NaCl
C= 8 oz of K-Carb
D= 4 oz of NaCl + 8 oz of K-Carb

- **Edema Scoring System**

1= No edema
2= Slight edema
3= Moderate edema
4= Severe edema
5= Very severe edema

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Treatments	Udder Edema Scores	
	-4 to 0 d pre-calving	1 to 5 d post-calving
A= No Salt	3.48 a	3.74 a
B= 4 oz of NaCl	3.81 b	3.82 b
C= 8 oz of K-Carb	3.91 b	3.69 ab
D= 4 oz of NaCl + 8 oz of K-Carb	3.79 ab	3.40 a

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Lets look at where "They say" comes from

Journal of Dairy Science : 1988

- **Statistics** (Incorrectly Analyzed as Analysis of Variance)
- **Data are Categorical**

Conclusion: Feeding 4 oz of salt significantly increased udder edema 1-5 d post-calving by 0.08 hundredths of an edema score (?)

- **4 Treatments (11 Heifers/Trt)** (Insufficient No# of Heifers?)
  - A= No Salt
  - B= 4 oz of NaCl
  - C= 8 oz of K-Carb
  - D= 4 oz of NaCl + 8 oz of K-Carb
- **Edema Scoring System** (May or may not randomly distributed?)
  - 1= No edema
  - 2= Slight edema
  - 3= Moderate edema
  - 4= Severe edema
  - 5= Very severe edema
- **Biological Mechanism(?)**

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Lets look at where "They say" comes from (Generalized)

- **1950s - Udder edema = dietary protein**
- **1960s – Udder edema = level of grain feeding**
- **1970s – Udder edema = dietary salt**
- **1980s - Udder edema = dietary K, Cl, Na, Ca**
- **1990s – Udder edema = genetics, season of year, dietary Fe**

To date true biological mechanisms behind udder edema are not well known.

What if udder edema is not mediated by diet?

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Udder Edema

Miller et al., (Selected Data)

Table 1. Milk yield at PM milking and decrease in udder floor area after milking in heifers supplemented or unsupplemented prepartum with vitamin E (Mueller et al., 1989).

	Udder shrink			Milk yield		
Day[1]	Control	Vitamin E	P > F	Control	Vitamin E	P > F
	---------- (%) ----------			---------- (kg) ----------		
1	14.7	22.9	0.10	3.6	6.9	0.02
2	19.0	24.5	0.16	4.7	8.4	0.01
3	16.0	24.4	0.02	6.0	8.2	0.01
7	24.4	26.6	0.57	7.8	9.7	0.10
14	38.4	39.2	0.86	10.3	12.3	0.08

[1]Day plus 1 equals day of lactation.

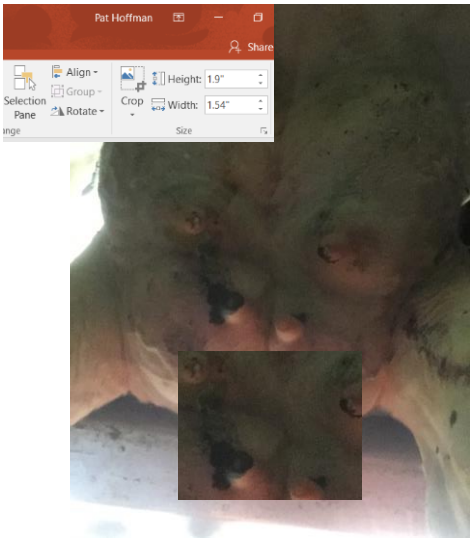
Table 3. Odds ratios[a] describing relationships among steroid hormones and udder edema in periparturient heifers (J.K. Miller, Univ. of Tennessee; Unpublished).

	Plasma antioxidants	Udder edema
Udder edema	0.21[b]	----
Corticosterone (C)[c]	1.12	2.14
Estradiol (E_2)[d]	1.11	0.42
Progesterone (P_4)[c]	1.20	1.37
C/E_2 ratio	0.16[b]	3.89[b]
C/P_4 ratio	0.64	1.62

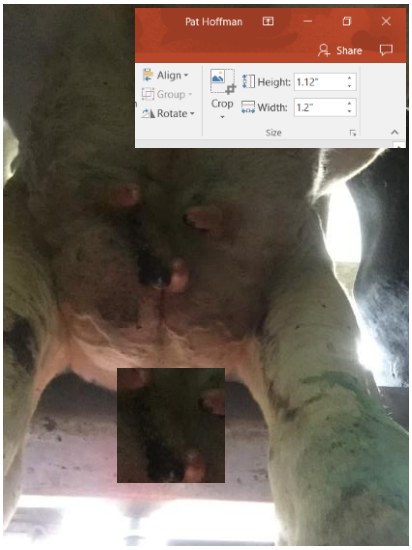
[a]If statistically significant, the relationship denoted by an odds ratio is positive if >1.0 and negative if <1.0.
[b]P < 0.05.
[c]Synthesized independently of 17α-hydroxylase or 17,20-lyase.
[d]Synthesis dependent on 17α-hydroxylase and 17,20-lyase.

Udder Shrink (54 %)

Pre-milking



Post-milking



Note: Measuring udder edema as udder shrink is a superior data technique as compared to using udder edema scores

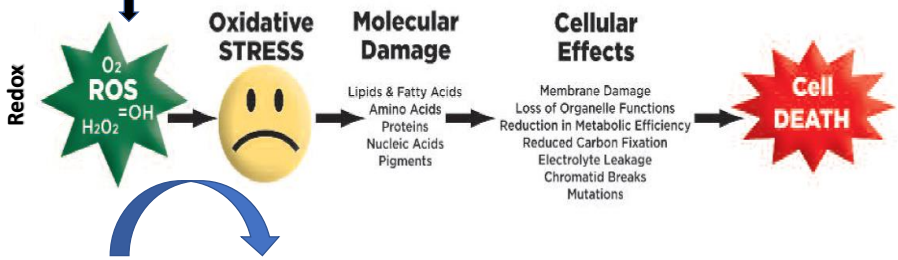
Udder Edema
Ir. J. Vet Res., 2015

Comparison of biochemical measurands determined in sera from heifers with udder edema

Measurands	Healthy heifers (n=35)	Affected heifers (n=35)	P-value
Na^+ (mmol/L)	139.23 ± 2.71	141.62 ± 2.89	NS
K^+ (mmol/L)	4.35 ± 0.31	4.41 ± 0.47	NS
Cl^- (mmol/L)	102.46 ± 2.75	103.14 ± 3.27	NS
Ca^{2+} (mmol/L)	2.46 ± 0.05	2.30 ± 0.05	<0.02
P (mmol/L)	2.26 ± 0.07	1.86 ± 0.07	<0.001
Mg^{2+} (mmol/L)	0.93 ± 0.03	0.98 ± 0.02	NS
TG (mg/L)	287.7 ± 11.3	260.6 ± 9.0	<0.05
Cholesterol (mmol/L)	4.24 ± 0.35	3.28 ± 0.15	0.001
HDL (mg/L)	902.5 ± 53.7	733.2 ± 21.7	<0.001
LDL (mg/L)	666.4 ± 100.9	475.2 ± 48.5	<0.05
VLDL (g/L)	157.9 ± 14.1	141.7 ± 6.4	NS
Total protein (g/L)	78.7 ± 2.9	71.3 ± 1.2	<0.01

Reactive Oxygen (Stressors)

- Vaccinations
- Disease exposure
- Crowding
- Pregnancy
- Environmental changes
- Diet



Antioxidants

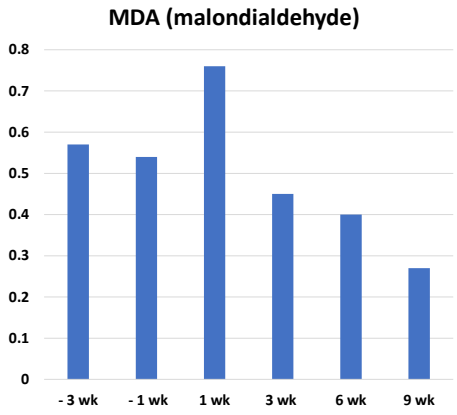
- Enzymes (SAT, GPX, CAT) – Zn, Se, Cu, Mn
- Vitamins (C, E, A, Beta Carotene)
- Diet (Phenolic, lignans, etc)

Oxidative Stress Markers in Transition Dairy Cows

Konvicna et a., 2015

An increase in free radicals causes overproduction of **MDA**.

Malondialdehyde is a **marker** of oxidative stress (lipid peroxidation).



Possible Clinical Manifestations of Oxidative Stress in Dairy Cattle

- Udder Edema (Purposed by Miller et al.,)
  - ***There is minimal evidence that dietary NaCl causes udder edema…….***
  - ***There is some evidence that Vit E and Se (antioxidants) increase udder shrink***
  - ***There is evidence that heifers with udder edema have altered lipoprotein mechanisms***
  - ***Maybe we should be feeding more antioxidants to pre-fresh heifers?***
- Post-partum mastitis (0-3 d)
- Retained placenta
- Metritis

Udder Edema in Pre-fresh Heifers – Lets be honest

- The cause is complex and we don't know for sure
- Dietary NaCl and K theories are very weak at best
- Stress + Colostrum Formation + Immune System likely depletes antioxidant/anti-inflammatory systems
- Reduce stress, disease pressure, overcrowding.
- Provide anti-inflammatory feeds (?)
  - Vitamin E
  - Selenium
  - Plant lignans
  - Omega 3 FA
  - Gama tocopherol
  - Beta Carotene (Provitamin A)
  - Phytochemicals (Various Feeds)

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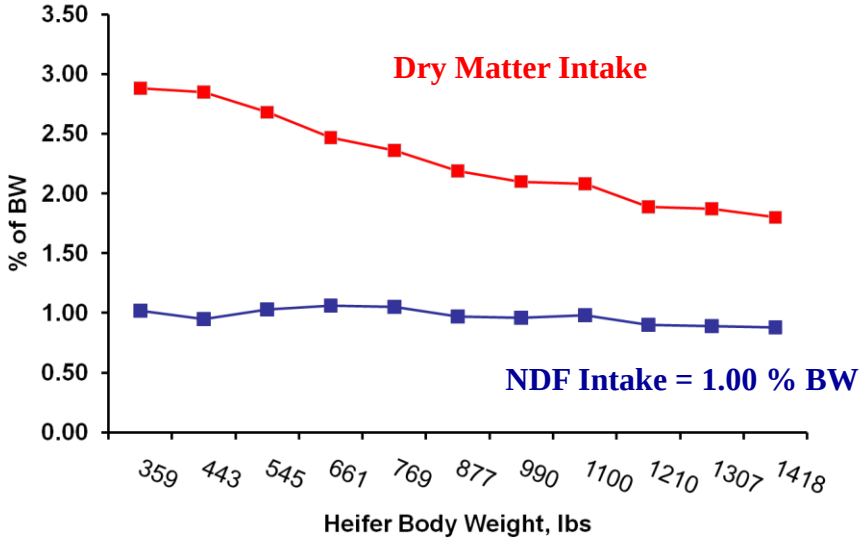
Review

Does Corn Silage Contain to Much Energy for Heifers ?

Or

Do Heifers Consume More Feed When Fed Corn Silage?

Its Both



Hoffman, et al., 2009 (>9000 pen DMI)

Napkin Math

A 1000 lb Holstein heifer eats 1.0 % of her BW as NDF

She will eat 10 lbs of NDF (1000 lbs x 0.01 = 10 lbs)

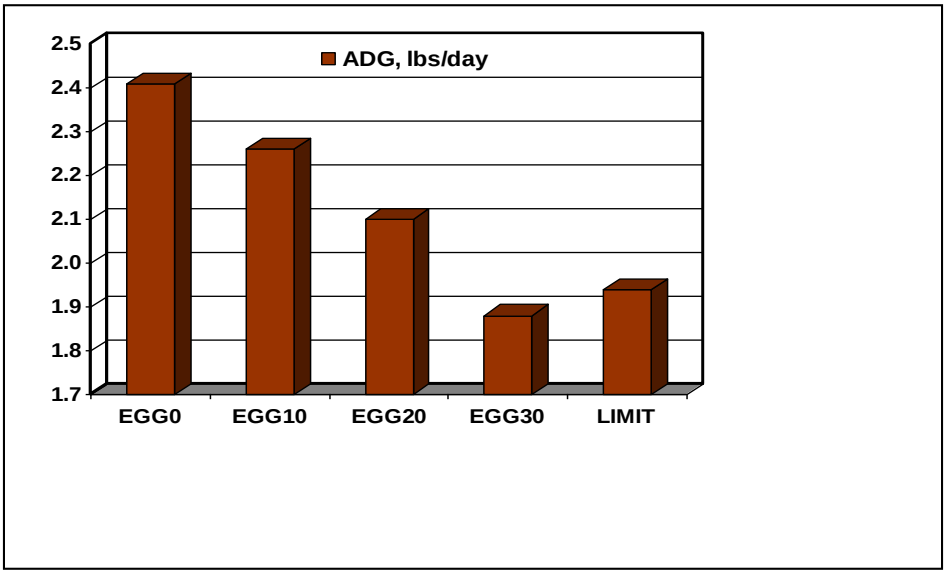
Fed a diet @ 40 % NDF she will eat 25 lbs of DM (10 lbs/0.40 = 25 lbs)

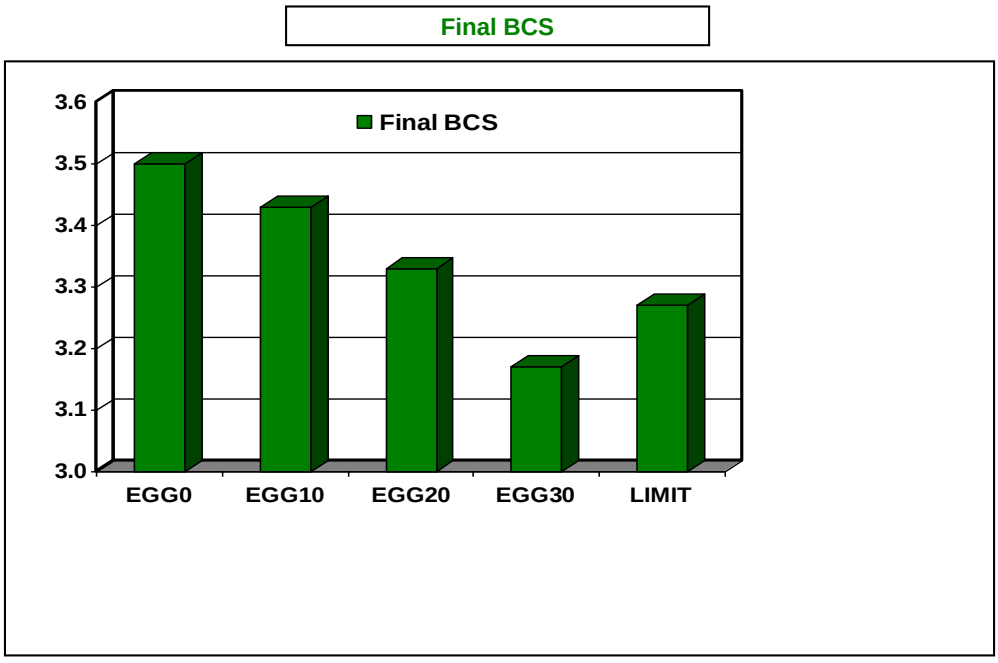
Fed a diet @ 50 % NDF she will eat 20 lbs of DM (10 lbs/0.50 = 20 lbs)

Diets and Heifers

	Diet				
Component	Control	10	20	30	LIMIT*
DM	40.1	39.9	40.5	40.6	40.1
CP	12.9	13.0	13.1	12.9	12.9
NDF	39.6	43.0	45.6	48.7	39.6
BW, lbs	939	928	931	925	920
NDF Intake, % BW	0.88	0.92	0.97	1.04	0.77

Average Daily Gain, lbs/head/day





But variation in AFC – Looks like excess body condition

To much variance of days on feed.....

- BW-Size-BCS variance
- Nutrition program
- Barn and pen flow
- Time in breeding pen (Do the math!~)
- Results in over-crowding
- Maturity pen management
- Transition health

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Heifer Management Report©

THE UNIVERSITY WISCONSIN MADISON

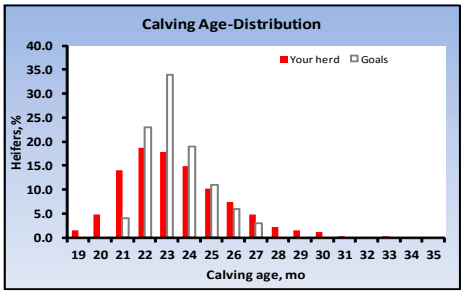
Breed Holstein

Herd	Herd 20
Address	
City, Zip	
email	

Developed by Patrick C. Hoffman, Department of Dairy Science, University of Wisconsin-Madison

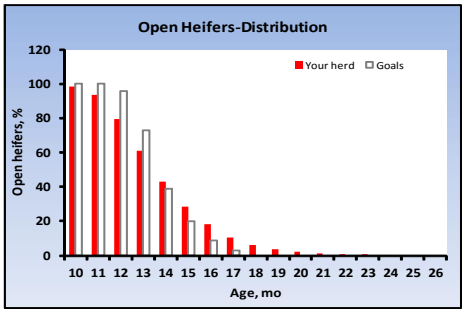
Calving Age (Averages and Variance)

	Your Herd	Goals
Summary Statistics		
Average age @ first calving, mo	23.5	23-24 mo
Minimum calving age, mo	19.0	na
Maximum calving age, mo	35.0	na
Heifers calving/year, n	1480	na
Calving age deviation, mo	2.41	< 1.7 mo
Kurtosis	1.62	na
Skewness	0.98	> 1.5
Range and Variance		
Youngest calving age (typical), mo	19.8	> 21 mo
Oldest calving age (typical), mo	28.8	< 28 mo
Calving age range (typical), mo	8.9	< 6.0
Days on feed variance, d	273	< 200
Calving body weight variance, lbs	464	< 325



Breeding Efficiency

True heifer pregnancy rate©, %/mo	31.0	> 42.5
Average pregnancy age, mo	14.5	14.0-14.5
First (start) breeding age, mo	11.6	12.5-13.0



Rearing Cost

Excess rearing days, days/heifer	23	0 days
Excess rearing cost, $$/heifer	$51.25	0 $$
Excess herd rearing days, days/herd	33713	0 days
Excess rearing cost, $$/herd	$75,855.36	0 $$

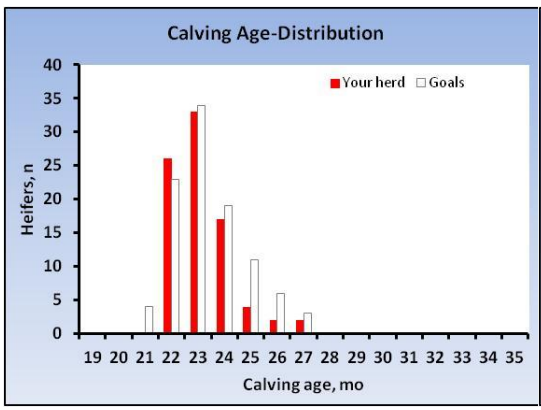
Nutrient management

Excess manure production, tons/year	421.4	0 tons
Excess P production , lbs/year	1770.0	0 lbs

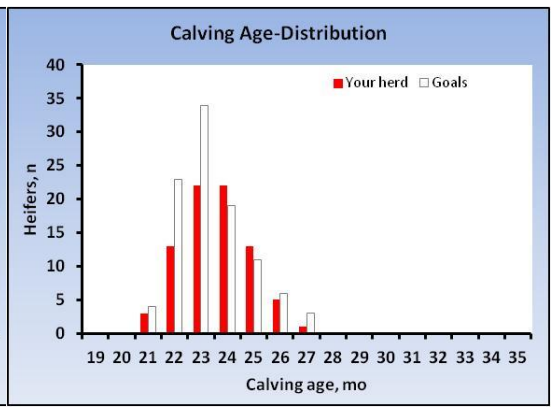
Heifer Breeding Criteria Study: Hoffman et al., 2013

- **163 Holstein Heifers**
- **Bred by Age or Weight**
- **High Reproductive Performance (Conception rate 54 %)**

Bred x Age (390 protocol)



Bred x Weight Only – 875 lbs



Modern Heifer Breeding Criteria - Example

- Pre Breeding Screen @ 12 months
  - Low Genomic Heifers Culled
  - High Genomic ET Donors Identified
  - Heifers with Respiratory Culled
  - Lightweight Heifers Culled
  - Heifers > 825 lbs Cleared
- Corrective Mating Protocols Employed
- Cull Heifers Exit
- Haplotypes Identified
- Heifers Bred on First Heat @or > 13 months
- 1-2 Straws of Sexed Semen
- Breeding Limited to 4 Straws
- Open Heifers Culled

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Early calving = increased profits

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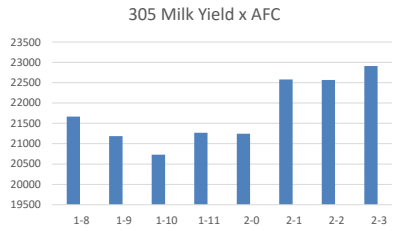
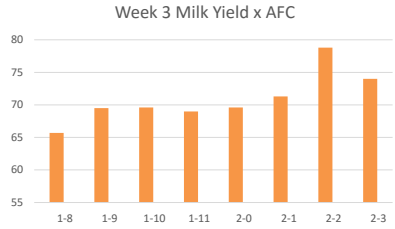
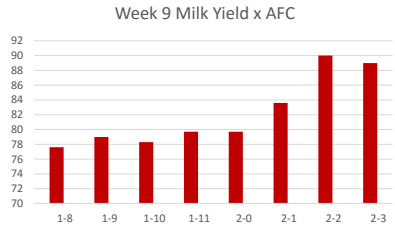
Age at First Calving x Milk Production Commercial Dairy Herd







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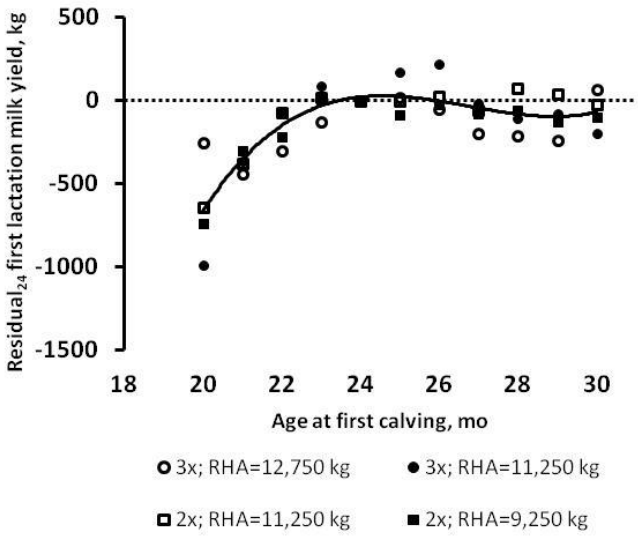
Carryover Effect of Age at First Calving on First Lactation Milk Yield



Curran et al., 2012

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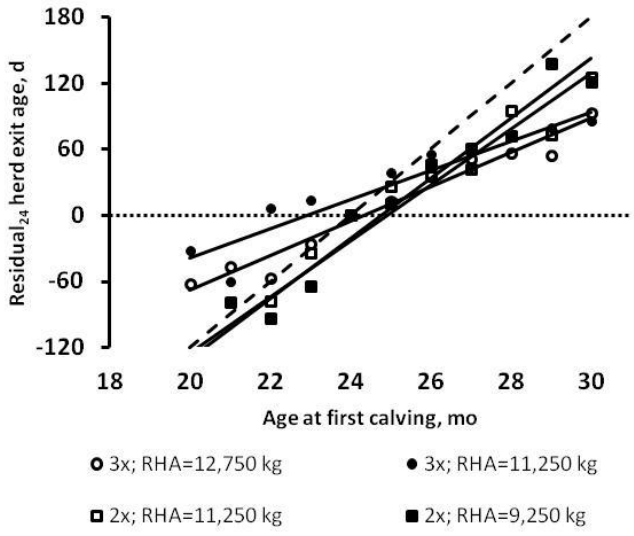
Curran et al., 2013
Wisconsin Dairy Herds 2005-2008

Reality:

The earlier a heifer calves the earlier she leaves the herd



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Take home messages

- More time – less moves
- Think 8th grade to high school
- Maybe oxidative stress is real?
- Calving heifers excessively young is not necessary
- Controlling age variance is necessary
- Breeding age and bred heifers require diets > 46 % NDF
- NDF regulates DM intake and feed cost

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