Real World Sources of Variance Associated with Heifer Performance

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Raising Calves and Heifers: Some Questions….

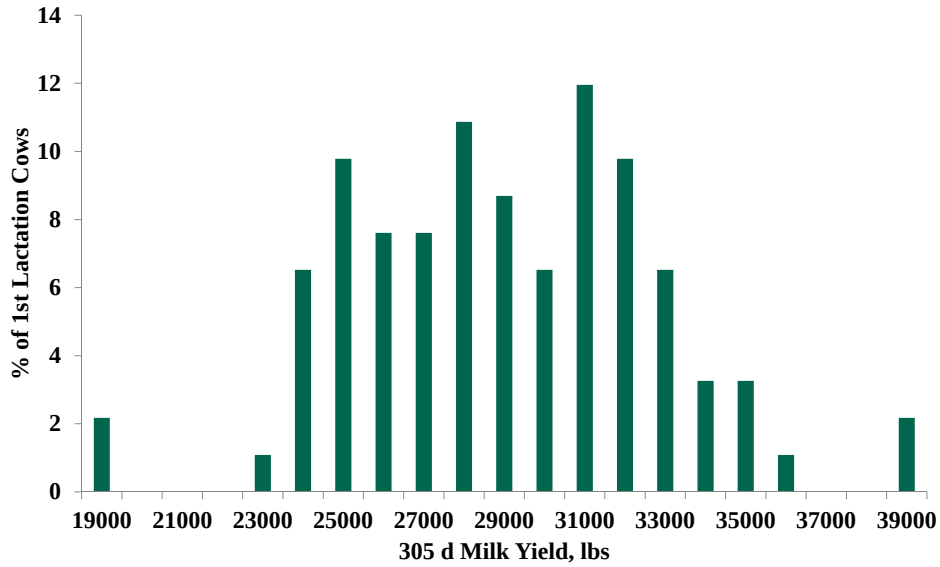
Why does a heifer become a great dairy cow?

Are all calves born with potential to become great dairy cows?

Do we only diminish their future milk production potential?

What is sort of BS-y, allegorical, kind of not real sure but it sounds good

Genetics….

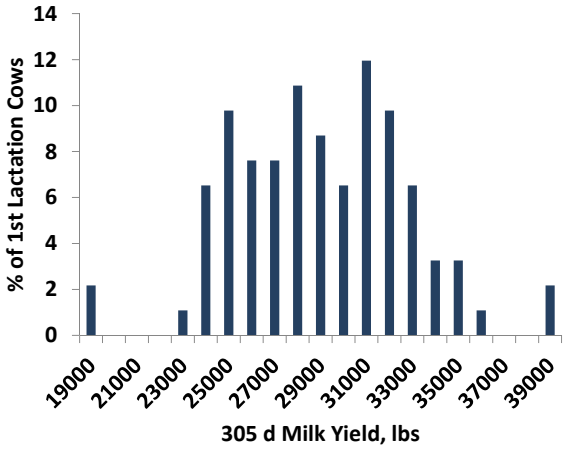

1st Lactation Milk Production (30,000 lb herd)
Bred AI 50 + years
% of 1st Lactation Cows
0
2
4
6
8
10
12
14
19000
21000
23000
25000
27000
29000
31000
33000
35000
37000
39000
305 d Milk Yield, lbs

What causes the variance?

Parent Average +

Mendelian Sampling Effect +

Environment/Management



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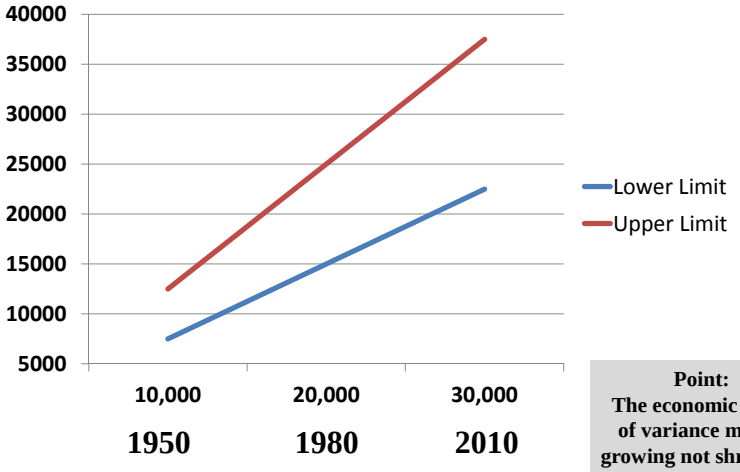
25 % SD Milk Yield (PA, Mendelian, Environment)



Point:
The economic value of variance maybe growing not shrinking.

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Courtesy of Dr. Kent Weigel



DEPARTMENT OF DAIRY SCIENCE
University of Wisconsin-Madison

Genotype by Environment Interactions

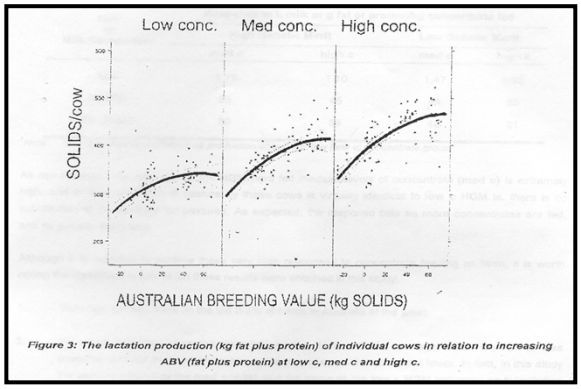
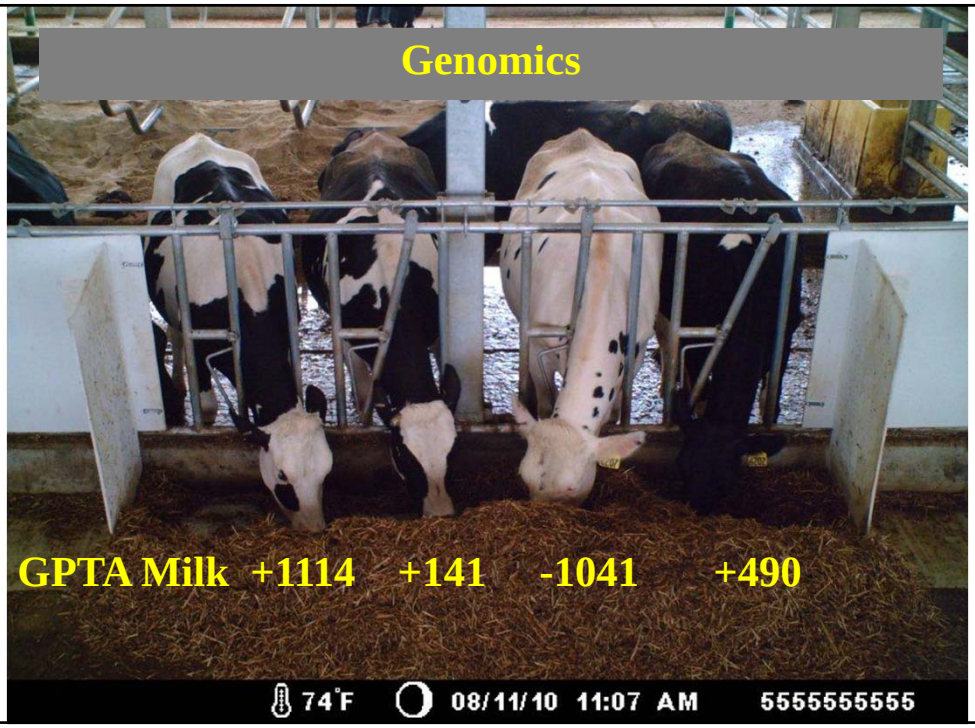
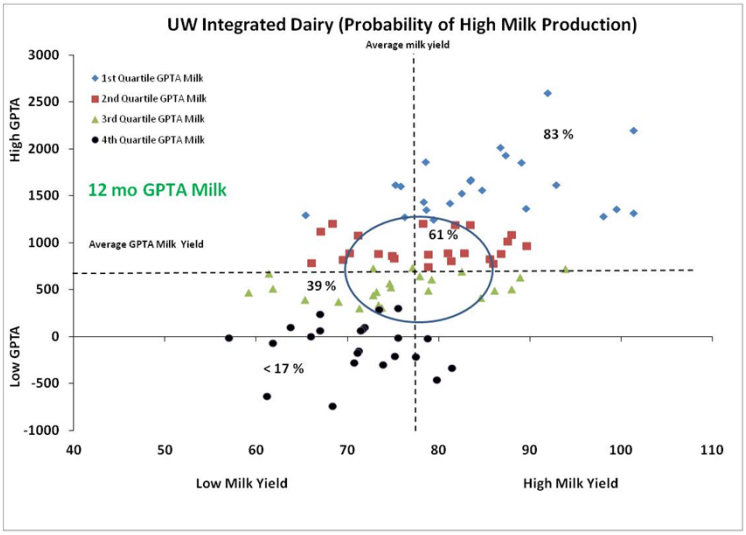


Figure 3: The lactation production (kg fat plus protein) of individual cows in relation to increasing ABV (fat plus protein) at low c, med c and high c.

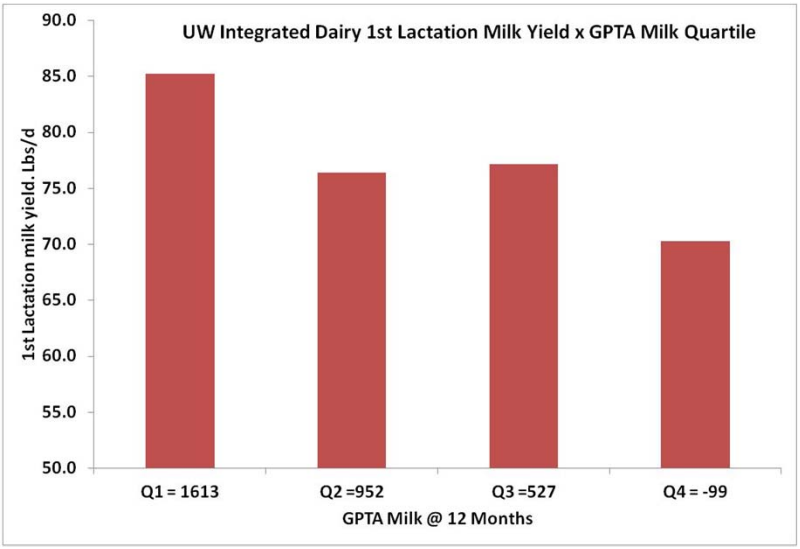
- Differences in the performance of daughters of high and low merit bulls became greater as the level of supplemental concentrates increased
- This indicates greater return on investment as management improves

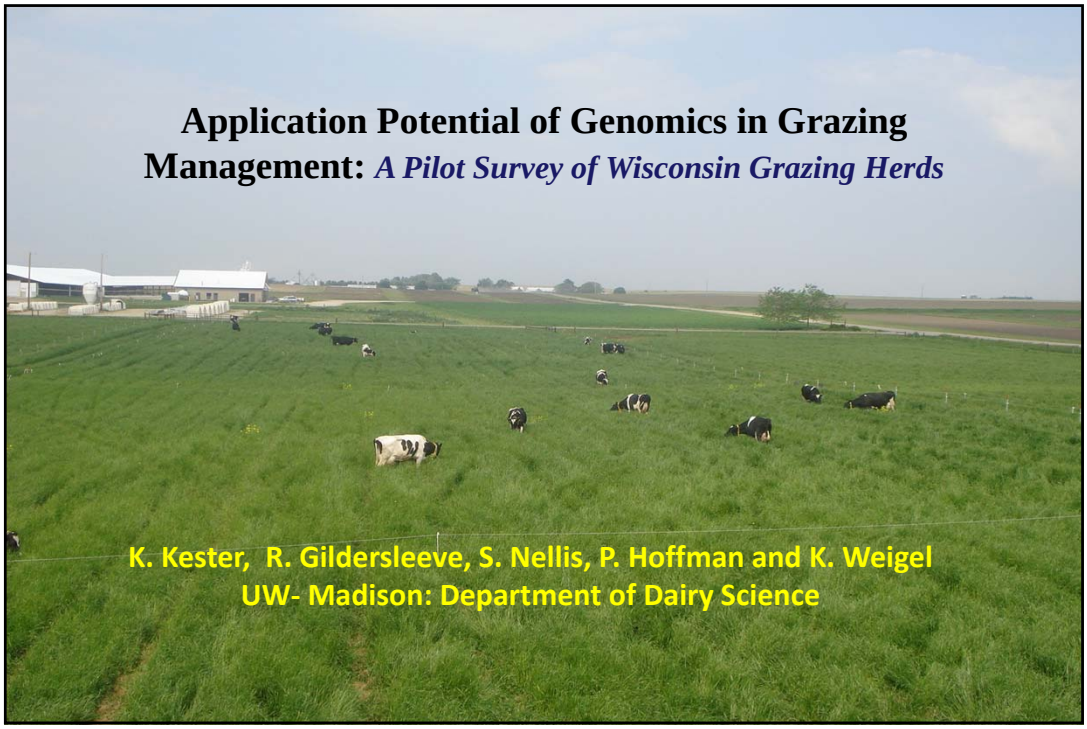


UW Integrated Dairy:12 mo GPTA milk vs 1st Lactation Milk (lbs/d)



UW Integrated Dairy:12 mo GPTA milk vs 1st Lactation Milk (lbs/d)





Summary statistics: Milk, fat and protein yield with corresponding genomic predicted transmitting abilities (GPTA) of producer defined good and poor grazing cows.

Item	Good grazing cows	Poor grazing cows	P<
Production, lbs/305 d			
Milk yield	21805	16511	<0.001
Fat yield	782	642	<0.001
Protein yield	613	498	<0.001
Total fat-protein yield	1398	1150	<0.001
Genomic PTA			
Net Merit, $	135	28.8	<0.001
Cheese merit	134	52	<0.03
Fluid merit	128	0	<0.001
Milk yield, lbs	259	-406	<0.001
Fat yield, lbs	15	-3	<0.001
Protein yield, lbs	5	-8	<0.001
Fat, %	0.01	0.04	0.25
Protein, %	-0.01	0.02	0.01
Parent average			
Milk, lbs	126	-236	0.02
Fat, lbs	6	-5	0.01
Protein, lbs	2	-3	0.15

Correlations between milk, fat and protein yield and genomic predicted transmitting abilities (GPTA) of producer defined good and poor grazing cows.

	Pearsons Correlations			
Item	Milk yield	Fat yield	Protein yield	Fat-protein yield
Genomic PTA				
Net Merit, $	*0.37*	*0.44*	*0.32*	*0.42*
Cheese merit	*0.21*	*0.39*	*0.27*	*0.37*
Fluid merit	*0.50*	*0.46*	*0.36*	*0.45*
Milk yield, lbs	*0.61*	*0.33*	*0.41*	*0.39*
Fat yield, lbs	*0.32*	*0.32*	*0.27*	*0.31*
Protein yield, lbs	*0.48*	*0.36*	*0.45*	*0.42*
Fat, %	*-0.33*	-0.04	-0.14	-0.10
Protein, %	*-0.44*	-0.07	-0.08	-0.08
Parent average				
Milk, lbs	*0.29*	0.20	0.20	0.21
Fat, lbs	0.15	0.13	0.15	0.13
Protein, lbs	0.19	0.20	0.20	0.19

Red denotes significant correlations

Calf Growth & Future Production

Milk Production-Intensified Calf Nutrition (Van Amburgh 2011)

Trial	Treatment Difference (lbs)
Foldager and Krohn 1994	3092
Bar-Peled et al., 1998	998
Foldager et a., 1997	1143
Ballard et al., 2005	1543
Shamay et al., 2005	2162
Rincker et al., 2006	1100
Drackley et al., 2007	1841
Morrison et al., 2009	0
Moallem et al., 2010	1613

Onfarm ID	933	941
Net merit (NM$)	436	-96
Breed Performance Index (BPI)	1791	1186
Milk Yield (Milk)	1562	-677
Fat %	-0.05	-0.03
Protein %	-0.04	0.02
Genomic Individual Inbreeding	11.4	12.3
HH1	F	F
HH2	F	F
HH3	F	C

305 day Milk and Pre-weaning ADG

Cornell University

- 305d milk yield in a traditional analyses
- Year of calving (P < 0.001)
- Preweaning ADG (P < 0.005)

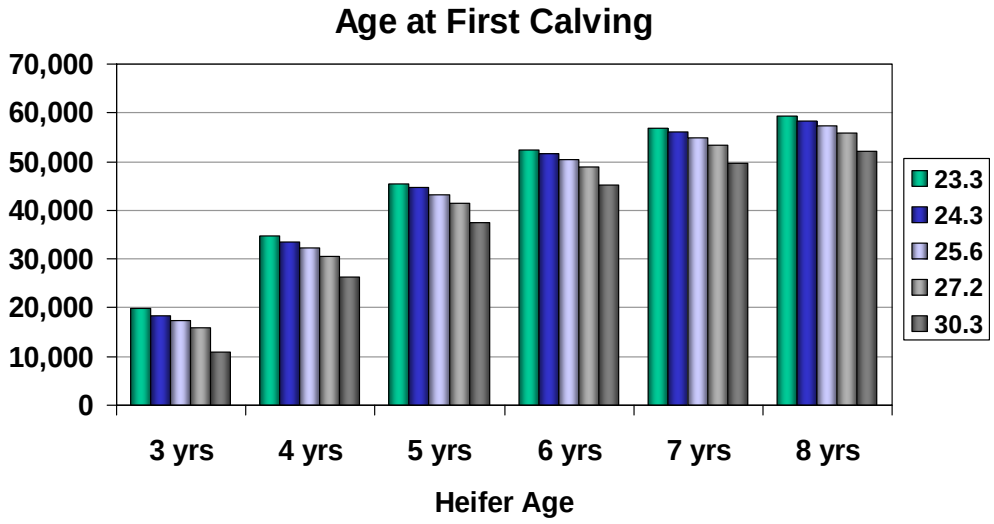
- For every 1 lb of ADG prior to weaning, milk yield increased 706 lb in first lactation

Cornell Study - **Effect of Pre-Weaning Daily Gain on Milk Yield**

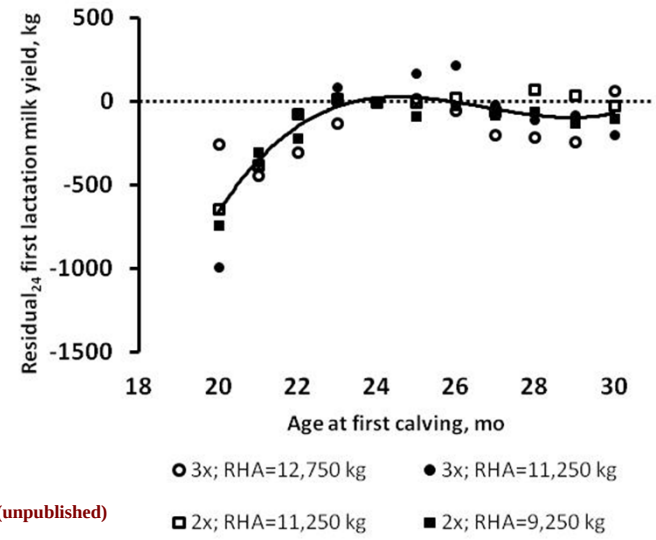
- 22% of the variation in first lactation milk yield was explained by pre-weaning growth rate up to 42 - 49 days of age
- Genomics accounts for 50-60 % of the variance in first lactation milk yield.
- Could genomics and calf ADG gain together account for 80 % of the variance in first lactation milk yield?
- We don't know.

Age of Calving Influences Milk Production

The common story = the earlier the better

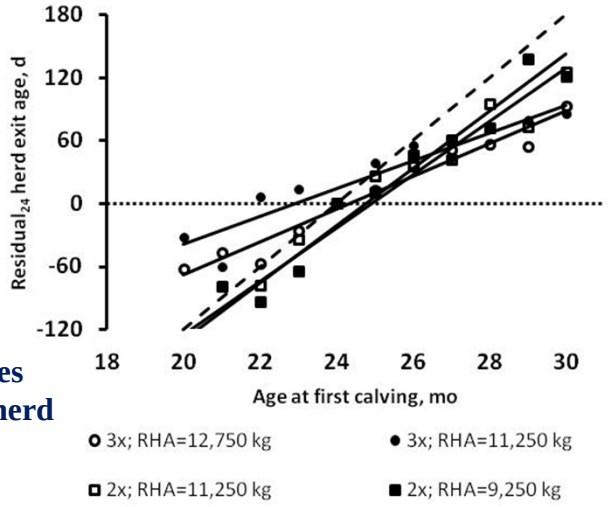


Carryover Effect of Age at First Calving on First Lactation Milk Yield

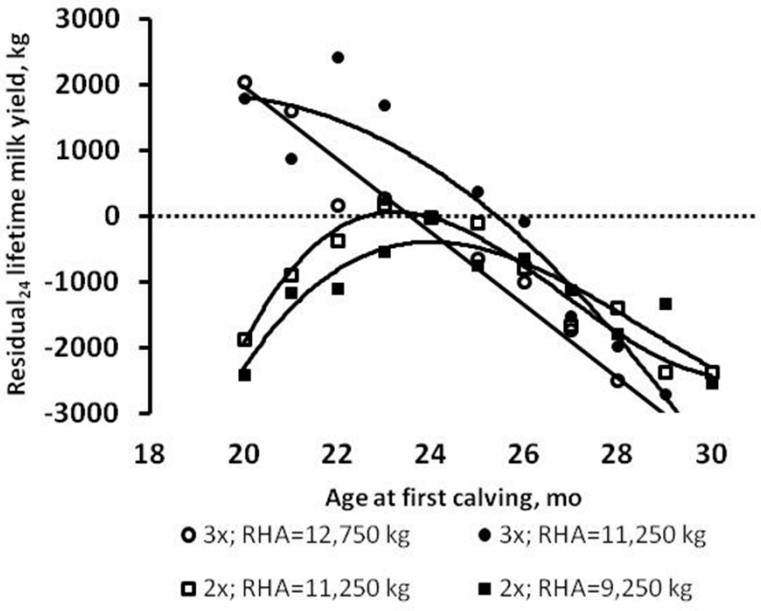


Curran et al., 2012 (unpublished)

Curran et al., 2012
Wisconsin Dairy Herds 2005-2008



The earlier a heifer calves the earlier she leaves the herd



What Influences Age at First Calving

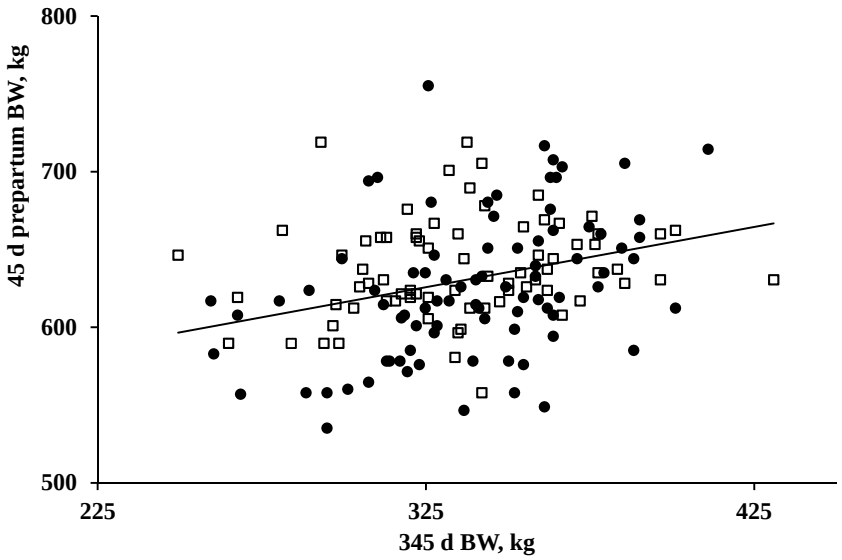
- ADG to Breeding
- Breeding Criteria (Age or BW)
- Service Rate
- Conception Rate

Thinking Points

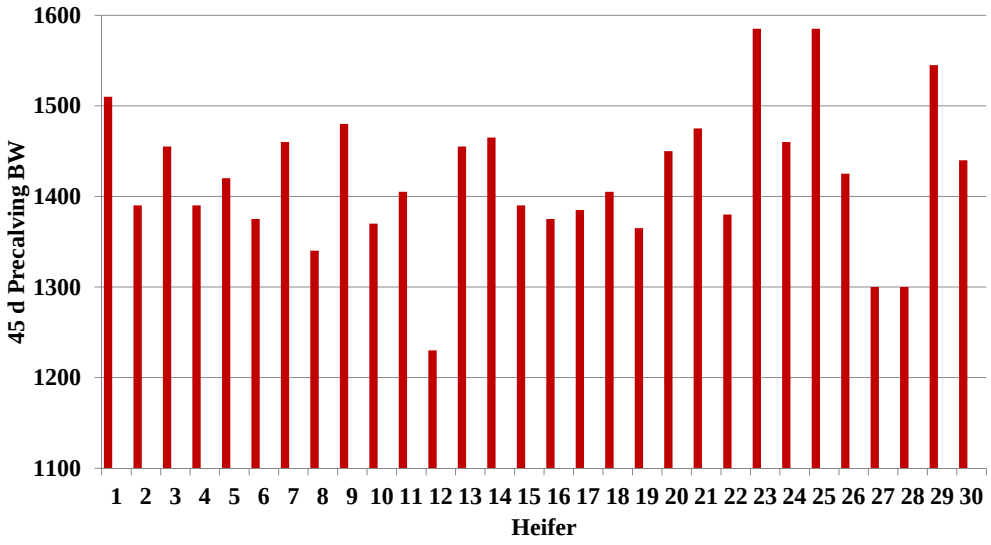
Herd ages at first calving are distributions ……..

Breeding by weight increases age (days on feed) variance…….

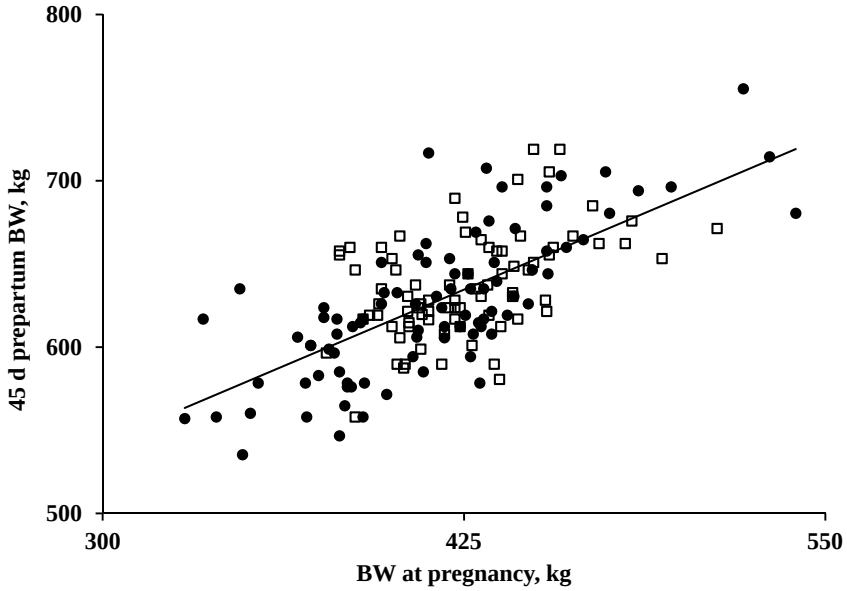
Reality = BW at 12 months is only partially related to calving BW.



30 Dairy Heifers: All Bred @ 875 lbs



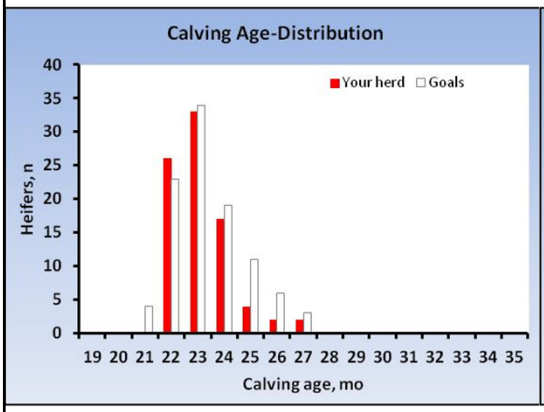
Reality = BW at pregnancy is more of an influence on calving BW



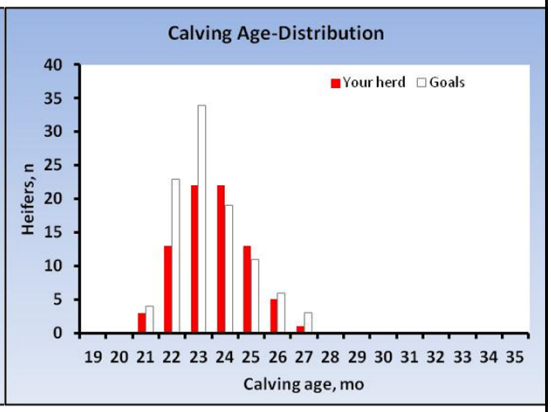
Heifer Breeding Criteria Study: Hoffman et al., 2013 (unpublished)

- 163 Holstein Heifers
- Bred by Age or Weight
- High Reproductive Performance (PR = 50 %)

Bred x Age Only – 13 months



Bred x Weight Only – 875 lbs



Heifer Management Report©

Breed: Holstein

Herd: Herd 20
Address:
City, Zip:
email:

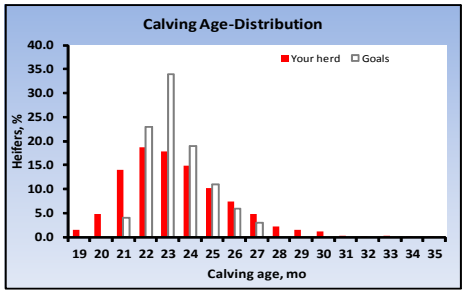
Developed by Patrick C. Hoffman, Department of Dairy Science, University of Wisconsin-Madison

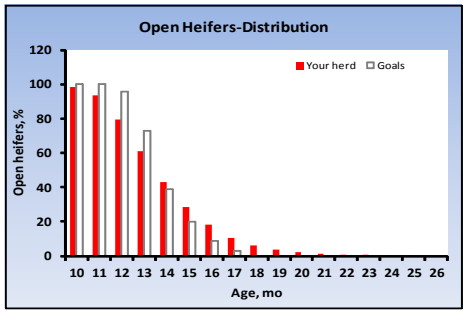
Calving Age (Averages and Variance)	Your Herd	Goals
Summary Statistics		
Average age @ first calving, mo	23.5	23-24 mo
Minimum calving age, mo	19.0	na
Maximum calving age, mo	35.0	na
Heifers calving/year, n	1480	na
Calving age deviation, mo	2.41	< 1.7 mo
Kurtosis	1.62	na
Skewness	0.98	> 1.5
Range and 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 Management Report©

THE UNIVERSITY OF WISCONSIN MADISON

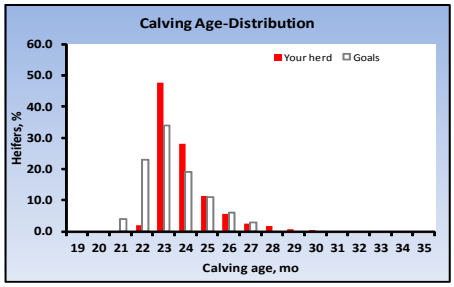
Breed: Holstein

Herd	
Address	
City, Zip	
email	

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

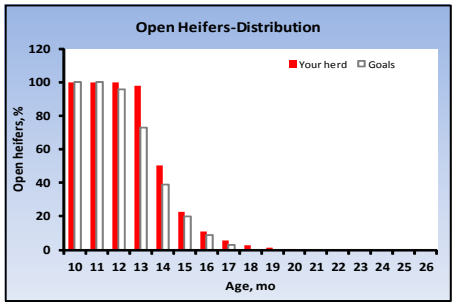
Calving Age (Averages and Variance)

	Your Herd	Goals
Summary Statistics		
Average age @ first calving, mo	23.4	23-24 mo
Minimum calving age, mo	21.1	na
Maximum calving age, mo	29.9	na
Heifers calving/year, n	1232	na
Calving age deviation, mo	1.32	< 1.7 mo
Kurtosis	3.82	na
Skewness	1.81	> 1.5
Range and Variance		
Youngest calving age (typical), mo	22.0	> 21 mo
Oldest calving age (typical), mo	27.0	< 28 mo
Calving age range (typical), mo	5.0	< 6.0
Days on feed variance, d	152	< 200
Calving body weight variance, lbs	259	< 325



Breeding Efficiency

True heifer pregnancy rate©, %/mo	49.8	> 42.5
Average pregnancy age, mo	14.4	14.0-14.5
First (start) breeding age, mo	13.7	12.5-13.0



Rearing Cost

Excess rearing days, days/heifer	0	0 days
Excess rearing cost, $$/heifer	$0.00	0 $$
Excess herd rearing days, days/herd	0	0 days
Excess rearing cost, $$/herd	$0.00	0 $$

Nutrient management

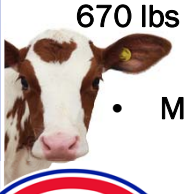
Excess manure production, tons/year	0.0	0 tons
Excess P production , lbs/year	0.0	0 lbs

Calf and Heifer Health

Carryover effects on lactation performance?

Enteric Disease - Impacts after 90 days

- 2.5 times more likely to be sold for dairy
- 2.9 times more likely to calve after 900 days On average 1 month after healthy animals (Waltner-Toews et al., 1986)
- Decrease first lactation energy corrected 305d milk production by 670 lbs (Svensson and Hultgren, 2008)



- Minimal effects in other studies.

Courtesy of Dr. Amy Stanton

Respiratory Disease: Long-term Impacts

- Increased risk of mortality prior to calving (Waltner-Toews et al., 1986; Stanton, 2012),
- Decreased growth (Virtala et al., 1996, Stanton 2012),
- Increased age at calving (Waltner-Toews et al., 1986; Correa et al., 1988, Stanton, 2012)
- Increased the risk of dystocia at first calving (Warnick et al., 1994, Stanton, 2012)
- 4+ cases of BRD = 1.9x more likely to leave during 1st lactation (Bach, 2011)

Courtesy of Dr. Amy Stanton

Cornell Study: Calf diseases and milk yield?

- 1st lactation milk yield was not affected by cases of diarrhea.
- Calves treated with antibiotics, produced 1,087 lb less milk in 1st lactation (*P > 0.01)* than untreated calves.

Courtesy of Dr. Mike VanAmburgh

Some Complexity

- Calves that were treated with antibiotics produced 623 lb more milk per lb of pre- weaning ADG
- Calves that did not receive antibiotics produced 1,407 lb more milk per lb of pre-weaning ADG.

Courtesy of Dr. Mike VanAmburgh

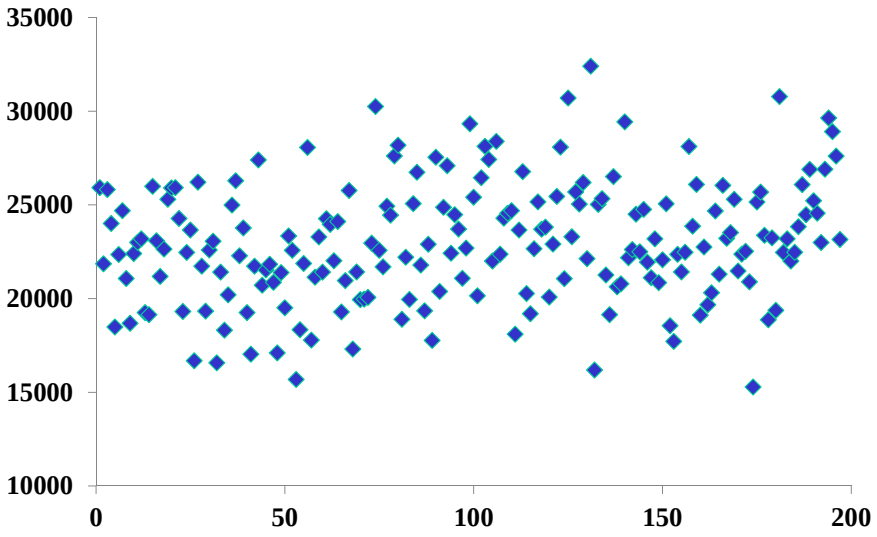
General Fuzzy Logic Conclusions

Why the big variance in milk yield these days

- Genomic PTA's of Holsteins for milk production range from -1000 to +2000
- Breeding value of Holsteins for milk production range from -2000 to + 4000
- Excessively early calving = -1000 lbs of milk
- Deficient Calf ADG = -500 lbs of milk
- Excellent Calf ADG = + 500 lbs of milk
- Multiple Calf Antibiotic Treatments = -1000 lbs of milk
- Lactation events (metritis, mastitis, DD etc) 0 to - 2000 lbs of milk

- All guesswork but……..

- *First lactation milk production could range from -6500 to + 4500 lbs of milk or 11,000 lbs*



Real World Sources of Variance Associated with Heifer Performance

Questions?

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