



DAIRY REPLACEMENT HEIFER MANAGEMENT: GOALS AND PROGRESS



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Calf Rearing Phase

Historic: Minimally fed milk or milk replacer to stimulate dry feed intake

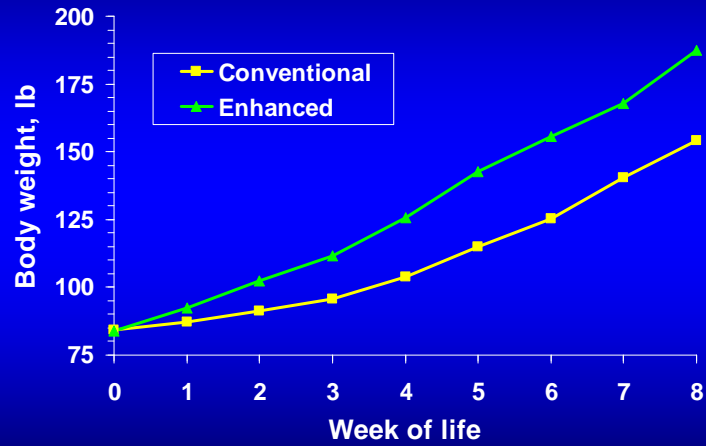
Modern Goal/Concepts:

Double birth weight by weaning

Improve calf labor efficiency

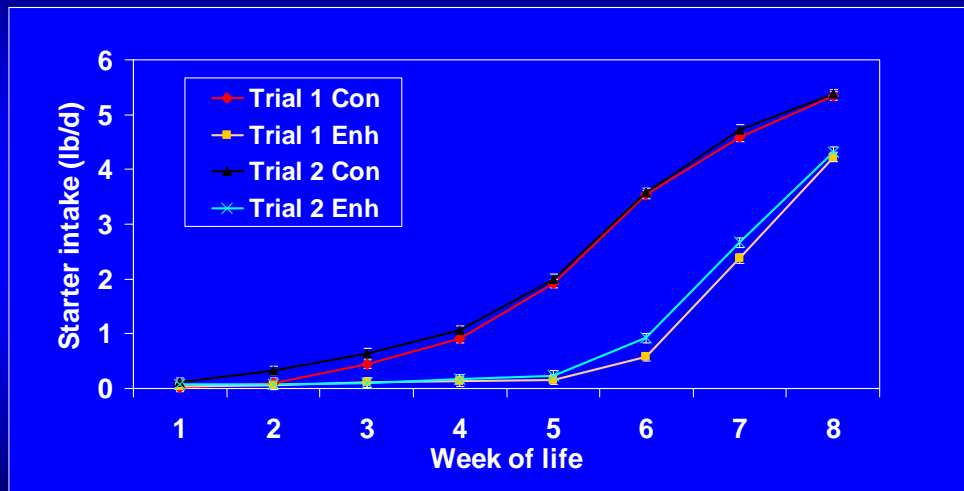
Decrease liquid feeding cost.

Enhanced early nutrition results in greater early growth of calves



Pollard and Drackley, 2002

Starter consumption



Both trials: Trt, $P < 0.001$; Trt \times week, $P < 0.001$

Pollard et al., 2003

Examples of Commercial Pasteurizers

■ HTST pasteurizer
161F(72C)/15 sec

■ Batch pasteurizer
145F(63C)/30 min



■ UV pasteurizer



Labor Efficiency



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

1st Phase Variance-Pre-breeding:

*Historic: Enhance mammary development by avoiding excessive ADG.
Holstein heifers ADG < 2.0 lbs/day.*

Modern Goals/Concepts:

2X Milking: Get every heifer on the breeding protocol on time (13.0-13.5 months) and on weight target

3X Milking:
Get every heifer on the breeding protocol on time (12.0-13.0 months) and on weight target

All Herds: Consider culling genetically inferior heifers prior to the pre-breeding rearing phase.

Genomics



AGTCCATGGGGTTATAGAGTCAGACACAGTGGAGTCACACACATACACACG
TCACCACGCCGAATTAAGGCGGGGCTGAGACAAGGGCAGGTGAGGCCCTCC

genotype

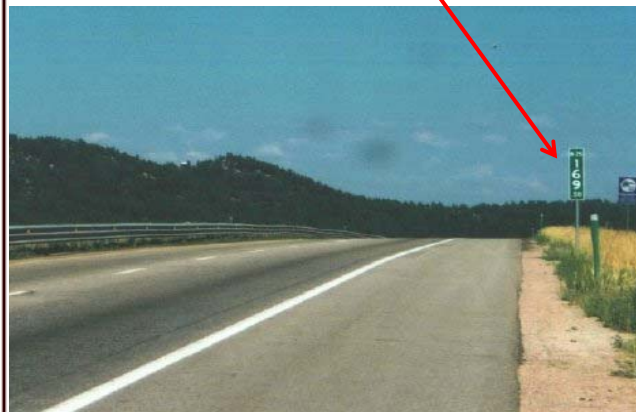
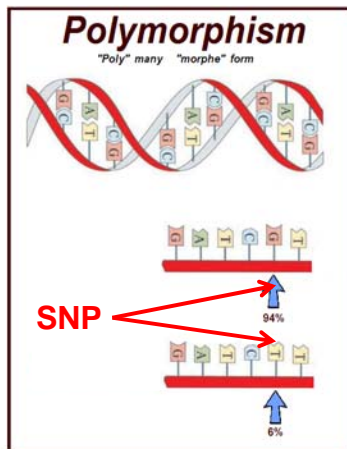
haplotype

- 30 pairs of chromosomes
- 3 billion base pairs (potential SNPs)



9

Single Nucleotide Polymorphism



Courtesy of George Wiggins, USDA-AIPL



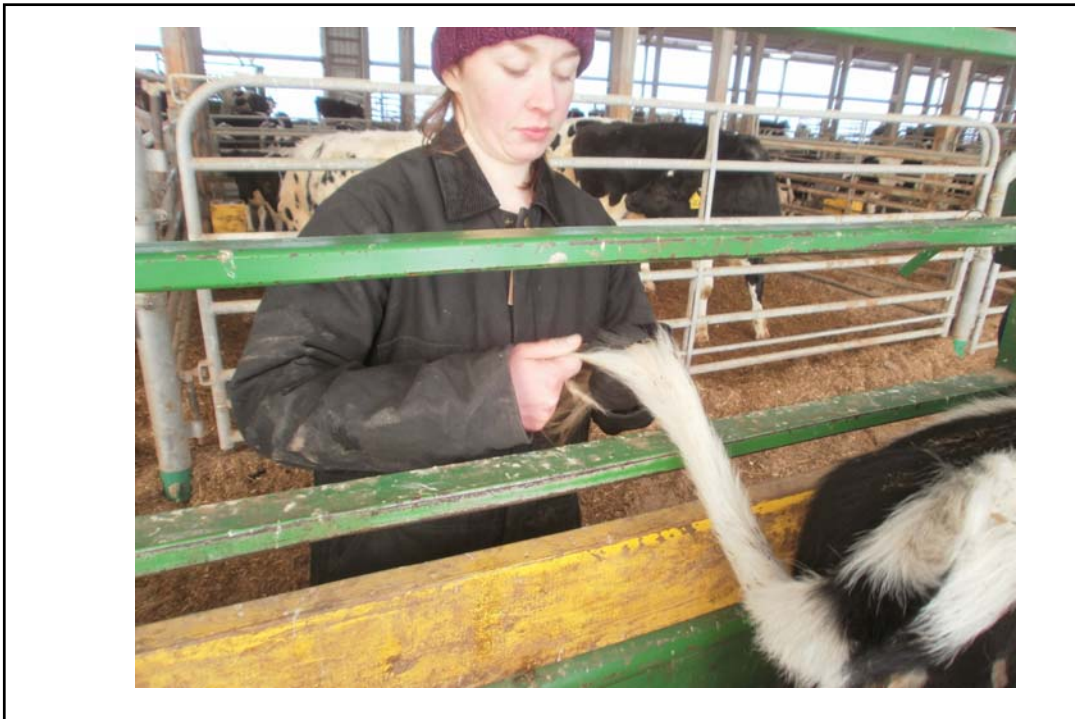
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Genomics

- 50,000 SNP >\$100.00 (Elite Animals)
- 3000 k SNP (Fall 2010) Discontinued
- 6000 k SNP Available \$40.00-45.00
- 3 drops of blood or hair
- Genomic PTAs by 2-3 months of age
- Reliability = 50.0-70.0 %
- Integrates Parent Averages
- Holstein/Jersey Association
- Pfizer (Clarifide)



**Lets Find Out
Genomics Step by Step**



Genomic Lab Results

- * Samples Due 1st of Month
- * Lab Turnaround = 30-40 days

WATERCREST MUSIC-ET HOUSA0000123456789 Birth date: 20101011 GFI: 5.6
Holstein Farm, 1500 Hill Rd, Sunny, PA 12345-6789

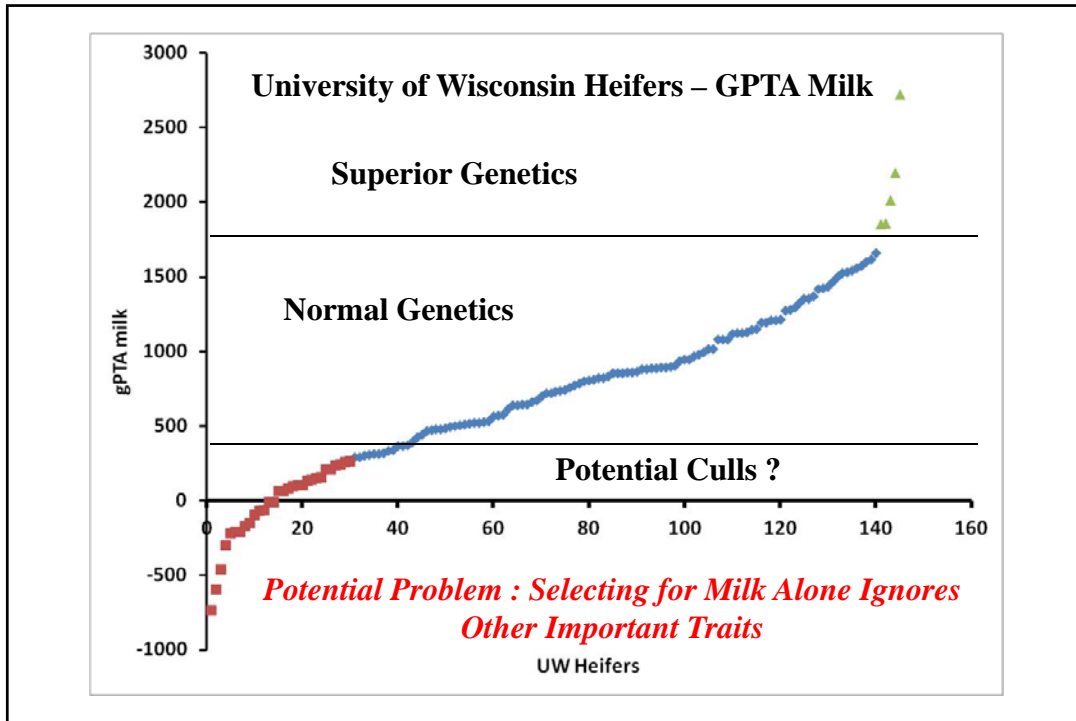
Trait	Genomic PTA	Official PA/PTA	Genomic REL %	Official REL %
HEALTH				
Net Merit(\$)	219	283	62	18
Daughter Pregnancy Rate (%)	-1.9	0.2	54	16
Productive Life (months)	2.9	2.7	56	16
Scamatic Cull Score	2.79	2.85	63	17
YIELD				
Milk	-227	-191	69	37
Fat (lbs)	1.5	21	69	37
Fat (%)	0.09	0.11	69	37
Pro (lbs)	12	11	68	37
Pro (%)	0.07	0.06	68	37
CALVING				
Daughter Calving Ease	9	8	59	25
Daughter Stillbirth	7.4	6.6	52	23
TYPE				
Final Score (PTAT)	2.25	1.84	61	34
Stature	1.57	1.46		
Strength	0.44	0.57		
Body Depth	0.83	0.56		
Dairy Form	2.21	1.42		
Rump Angle	-1.29	-0.77		
Thurl Width	0.80	1.15		
Rear Legs Side View	-0.52	-0.22		
Rear Legs Rear View	1.41	1.82		
Foot Angle	1.32	1.30		
Feet & Leg Score	0.61	1.00		
Fore Attachment	2.42	2.07		
Rear Udder Height	1.92	2.21		
Udder Cleft	0.93	0.64		
Udder Depth	1.31	1.14	65	36
Front Teat Placement	0.34	-0.28		
Rear Teat Placement	0.45	0.19		
Teat Length	-0.56	1.04		
Feet/Legs Composite	0.92	1.17	NA	NA
Udder Composite	1.43	1.36	NA	NA
TPI	1660	1726	NA	NA

Genomic PTA calculated using 3K test, March 2011

 **HOLSTEIN ASSOCIATION USA, INC.**
1 Holstein Place, PO Box 806, Brattleboro, VT 05302-0808 www.holsteinusa.com • 800.952.5200

• Genomic Results GPTA Milk (4 Heifer Example)





Some Math: Culling the bottom 15-25 % of heifers has a big effect on genetic improvement

GPTA milk +1114 +141 -1041 +490

3 Heifer Average = 581 GPTA milk

4 Heifer Average = 176 GPTA milk (Common AI Improvement)

74°F 08/11/10 11:07 AM 5555555555

Stringing

Old Heifer Management Paradigms Cause Stringing

- Average Daily Gain
- Average Age at First Calving
- Breed when she's 875 by eyeballometrics
- Breed when she's 50 " tall

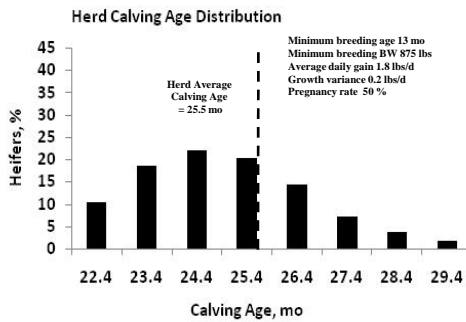
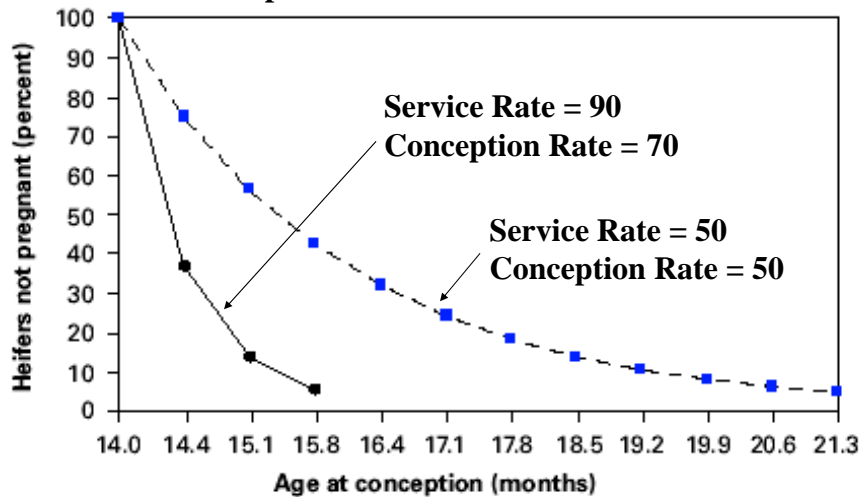
All of these general historic concepts increase the variance of days on feed

Total Rearing Cost = \$\$/day * days on feed

Heifers shouldn't tell dairy producers when their ready to breed.
Dairy producers tell heifers.....

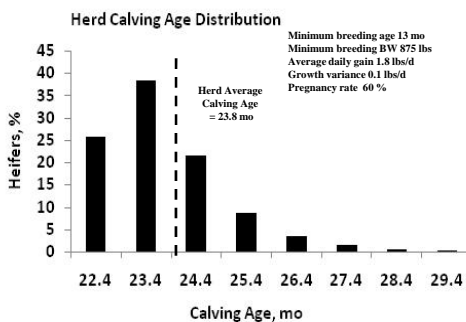
Normal AI Efficiency Causes Stringing +

- Sexed Semen ?
- ET ?
- Recipients ?

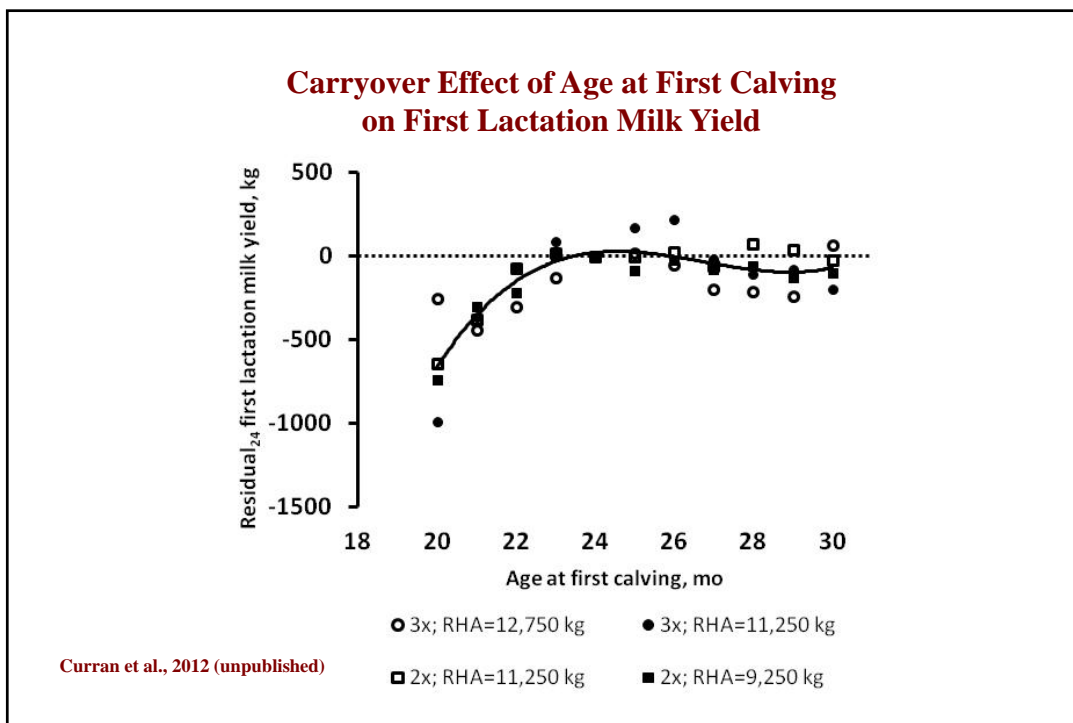
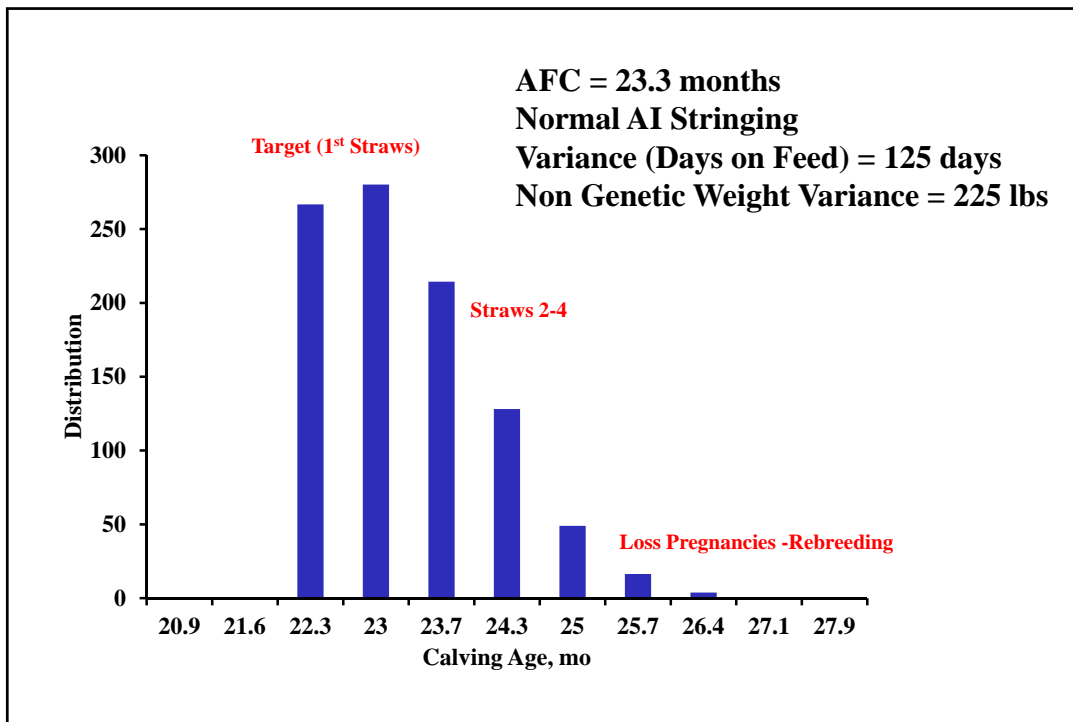


Breed Target Variance and Reproductive Efficiency Influence Age of Calving

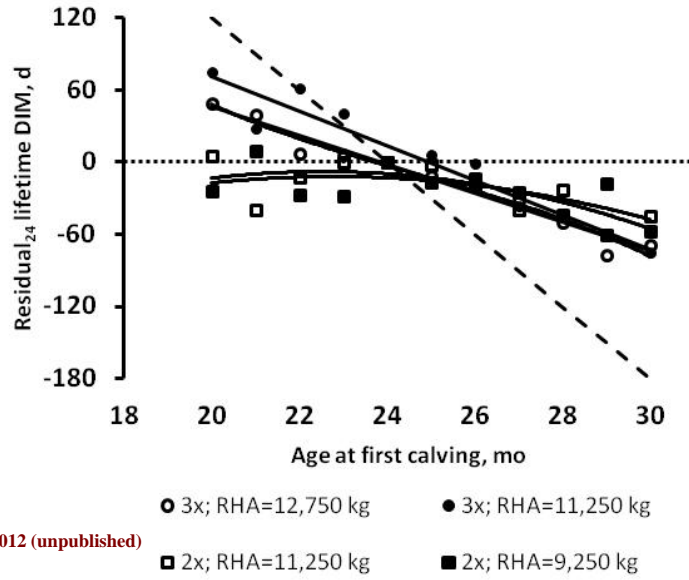
A Normal Distribution is Not Normal - Stringing



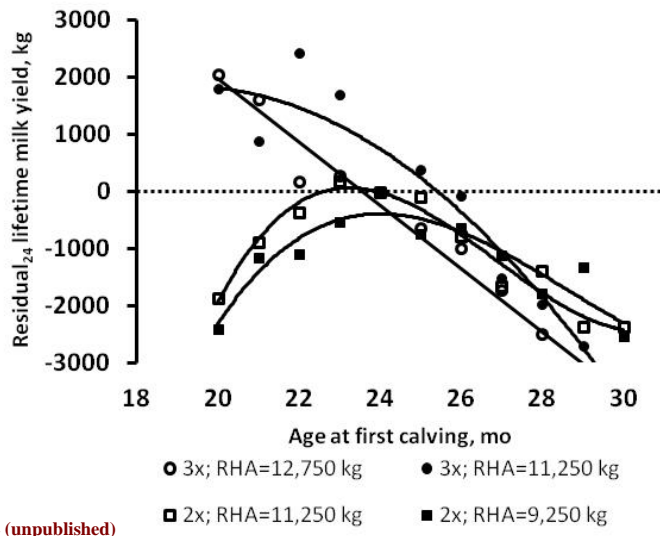
Steep Right Tail Distribution are Desired – No Stringing



Carryover Effect of Age at First Calving on Lifetime Days in Milk



Carryover Effect of Age at First Calving on Lifetime Milk



2nd Phase Variance-Breeding

Historic: Breed Holstein heifers by body weight (875 lbs) or by height (50 inches).

Modern Goals/Concepts:

Initiate breeding all heifers by age with minor consideration of delaying breeding of some heifers which are notably light weight for non-genetic reasons,

Service rate > 90 %₁

Conception rate > 65 %₂

Pregnancy rate > 60 %₂

Potentially breed heifers with high genetic merit with sexed semen

Sexed semen pregnancy rate > 55 %₃

Consider mating services for heifers facilitate by genomic testing,

Do not breed HH carrier heifers to HH carrier bulls.

Onfarm ID	HH1	HH2	HH3
6658	F	F	F
6660	F	F	F
6661	F	F	F
6662	F	F	F
6664	F	F	F
6666	F	C	F
6667	F	F	F
6669	F	F	F
6670	F	F	F
6671	F	F	F
6673	F	F	F
6676	F	F	F
6677	F	F	F
6678	F	F	F
6679	F	F	F
6680	F	F	F
6681	F	C	F
6682	F	F	F
6683	F	F	F
6684	F	C	F
6686	F	F	F

Supplemental Information

**Haplotype Carriers (HH1 HH2 HH3)
are Identified**

- Do not breed to HH Carrier Bulls
- > Chance of Failed Conception,
Early Embryonic Loss, or Abortion

Supplemental Information

Onfarm ID	Cheese Merit (CMS)	Milk Yield (Milk)	Fat %	Protein %	Final Score Type (Type FS)	Stature (ST)	Strength (SG)	Genomic Individual Inbreeding (Ind Inbrd)
924	22	215	-0.01	0.02	-0.26	0.36	0.02	7.6

AI Mating Services are Adapted for Genomic Data

- **Production Mating (NM, Cheese Yield, Milk, Fat, or Protein etc)**
- **Inbreeding Defined by Genomics is Considered**
- **Many Type and Traits for Consideration (Limited Example Above)**



Heifer Management is Changing

- Year 1 Technologies =
- Advanced Breeding Pen Management

3rd Phase: Post breeding

Historic: Maintain ADG of 1.8-1.9 lbs to assure adequate body weight at calving

Modern Goals/Concepts:

Capture feed efficiency

Reduce nutrient excretion

Precision Feeding of Gravid Holstein Heifers: Effect on Growth, Manure Nutrient Excretion, and Subsequent Early Lactation Performance

JDS 90 P.C. Hoffman, C.R. Simson, M. Wattiaux



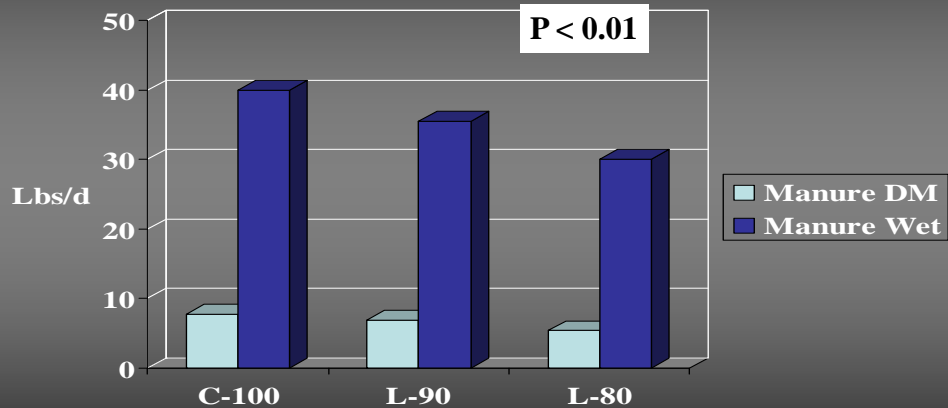
Journal of
Dairy Science

Effect of precision feeding on body size and growth of replacement heifers.

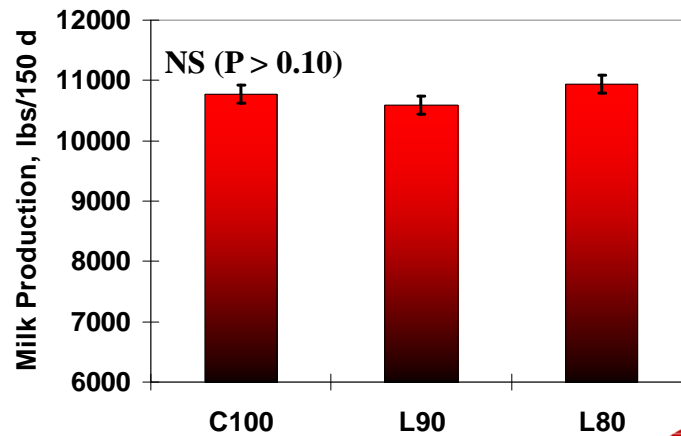
Item	Treatment ¹		
	C-100	L-90	L-80
Initial			
Weight, lbs	1036	1021	1011
Hip height, in	54.2	54.6	54.9
Body condition score	3.1	3.0	2.9
Final			
Weight, lbs	1220	1234	1217
Hip height, in	56.0	56.3	56.4
Body condition score	3.2	3.2	3.2
Growth			
Average daily gain, lbs/d	1.66	1.92	1.84
Feed efficiency, lbs DM/lb gain	13.2	10.7	11.1
Excretion			
DM, lbs/d	7.7	6.9	5.8

Hoffman et al. 2005

Fecal Excretion – 1100 lb Precision Fed Holstein Heifers



Milk Production: 150 DIM (3.5 % FCM):




Penn State – Lactation Trial

	High Forage	Precision Fed	SE	<i>P</i> <
Milk, lbs	20761	23041	1045	0.081
Fat, %	3.74	3.98	0.13	0.138
Protein, %	3.05	2.95	0.05	0.118

Production: Milk Yield Kruse et al., 2010

	C100	L85	L80 + I	SEM
Heifers, no.	26	29	26	
45 DIM				
3.5% FCM yield, kg/d	80.9	83.0	78.4	1.1
90 DIM				
3.5% FCM yield, kg/d	75.0	77.5	75.9	1.1




Nutrient Management Progress (?)

Bone development in dairy heifers fed diets with and without supplemental phosphorus.

N.M. Esser*¹, P.C. Hoffman*, W.K. Coblenz[†], M. W. Orth^{††} and K.A. Weigel*.

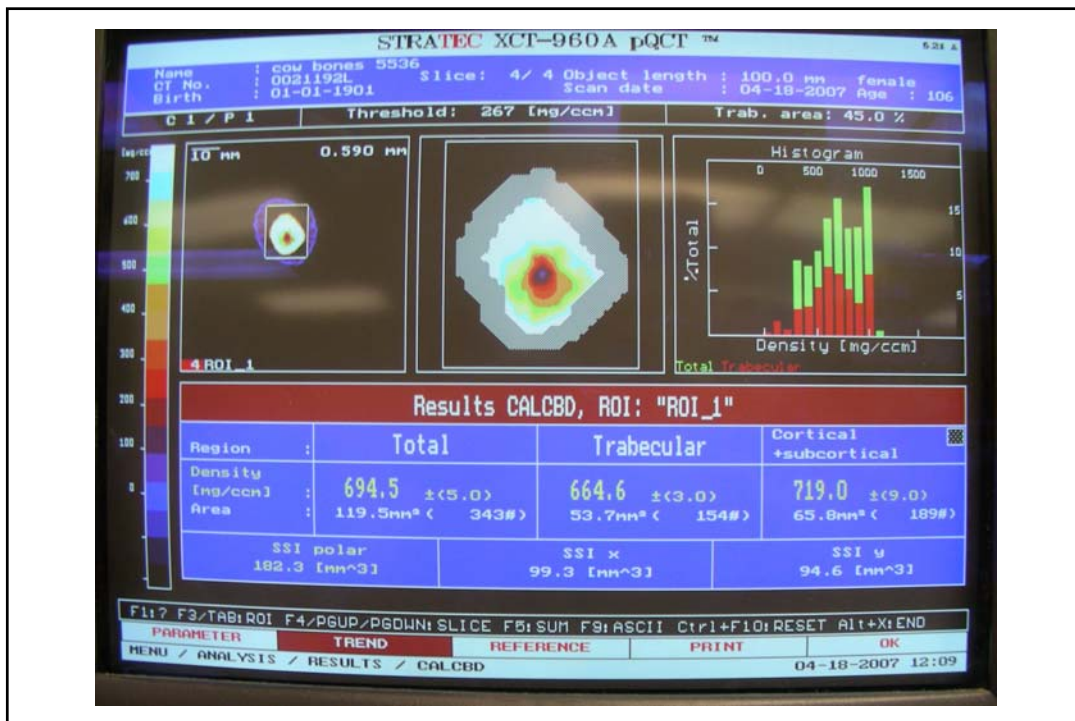
- Department of Dairy Science, University of Wisconsin, Madison, WI.*
- [†] *USDS-ARS Dairy Forage Research Center Marshfield and Madison, WI.*
- ^{††} *Michigan State University, East Lansing, MI.*



**Holstein and Crossbred Heifers 3-22 months of age.
Experimental Diets**

- Unsupplemented = 0.28 % P
- Supplemented = 0.38 % P


Item	0.28 % P		0.38 % P		Effect (P< Diet
	Holstein	Crossbred	Holstein	Crossbred	
Body weight, lbs	1370.0	1263.1	1406.3	1293.1	ns
Hip height, in	57.4	54.5	57.3	54.8	ns
Hip width, in	22.0	20.8	22.0	21.3	ns
Body length, in	65.1	64.9	65.1	64.8	ns
Heart girth, in	81.1	78.9	81.0	79.8	ns
Cannon bone, in	11.1	10.6	11.4	10.6	ns
Pelvic height, cm	16.9	16.5	16.6	16.8	ns
Pelvic width, cm	15.8	15.8	16.4	15.9	ns
Pelvic area, cm ²	210.8	205.4	214.3	210.4	ns
Pelvic length, in	22.1	21.4	22.3	21.5	ns



**Holstein and Crossbred Heifers 3-22 months of age.
Experimental Diets**

- Unsupplemented = 0.28 % P
- Supplemented = 0.38 % P

Item	0.28 % P		0.38 % P		Effect (P< Diet
	Holstein	Crossbred	Holstein	Crossbred	
Bone density					
Trabecular bone density, mg/cm ³	466.5	439.3	407.9	456.5	ns
Cortical bone density, mg/cm ³	573.2	588.6	628.1	562.5	ns
Total bone density, mg/cm ³	525.4	521.6	529.2	514.7	ns
Chemical composition					
P, %	10.3	10.4	10.6	10.4	0.08
Ca, %	20.2	20.5	21.0	20.4	ns
Ash, %	58.2	58.3	58.4	58.0	ns



1st Lactation Production

	Phosphorous Treatment	
	High (N=165)	Low (N=168)
305 Day Milk	18,982	18,808
ME 305 Milk	23,846	23,768
Peak Milk	75.6	75.7
Total Milk	20,598	19,978
Total Fat	810	800
Total Protein	661	645
Fat-Corrected Milk	66.5	66.3
Average Log SCC	2.82	2.95
Average MUN	14.5	14.4
Average Milking Speed	5.59	5.43

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