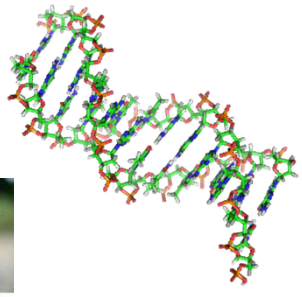
What's New in Genomics; Use of Technology and Management Tools

Ray Nebel, PhD
V.P. Technical Service Programs

Select Sires Inc.
Plain City, OH 43064
rnebel@selectsires.com



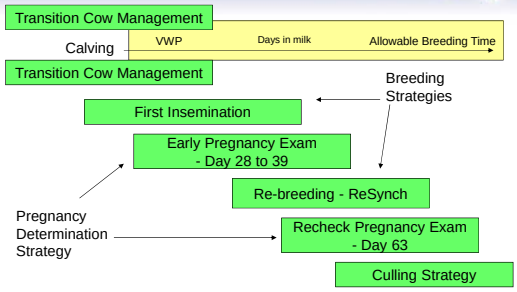
Goal of Reproductive Program

- Have minimal difficulties with calving
- Have minimal reproductive pathology post-partum
- Begin normal estrous cycles at early DIM
- Accurately detected cows in estrus and A.I. or A.I. at a fertile ovulation following synchronization
- Pregnancies occur in a timely manner
- Minimal abortion incidence
- Calve again with minimal difficulties

The Value of Good Reproduction

- **The objective of a dairy operation is to generate profit.**
- **To maximize milk production and profit, producers strive to achieve high reproductive performance.**
  - Increase the frequency of peak milk production, which is the time when cows are most profitable
  - Reduce average herd Days In Milk (DIM)
  - Reduce need for replacements
  - Accelerate genetic improvement of the herd

Reproductive Management Program

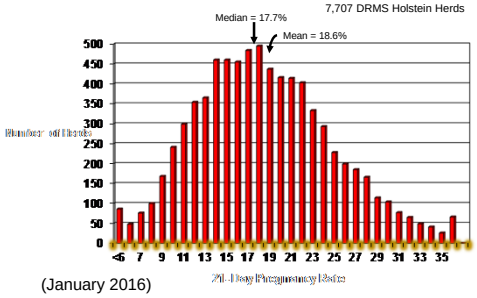


All of the components require "managerial" efforts

Pregnancy Rate

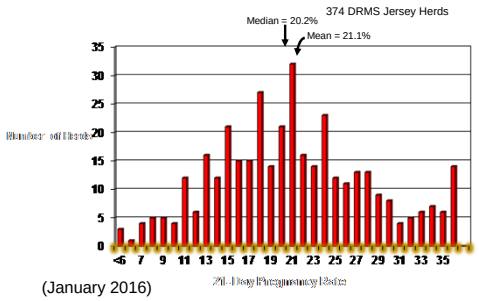
- **Key influencers:**
  - **Insemination rate per 21-days – (In A.I. herds, estrus detection/ timed A.I.)**
    - **Function of cyclicity**
    - **Ability to detect estrus**
    - **Ability of cows to display estrus**
    - **Management/ adherence to TAI protocols**
  - **Conception rate per 21-days**
    - **Accuracy of heat detection**
    - **Semen handling and placement**
    - **Health of the cow/ repro tract**

21-day Pregnancy Rate

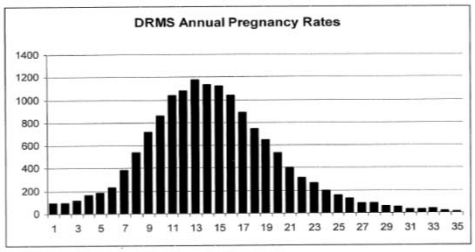


(January 2016)

21-day Pregnancy Rate

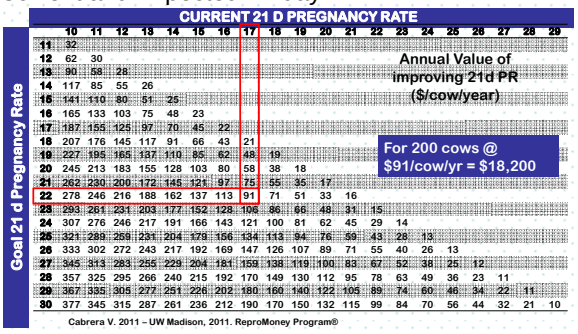


(January 2016)



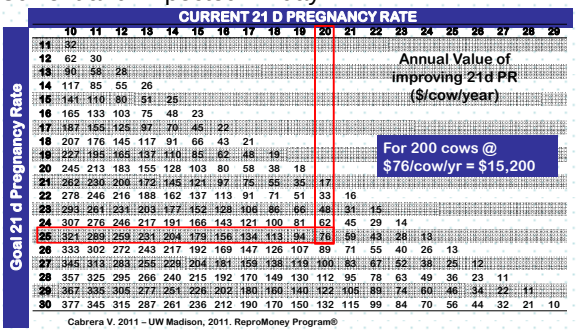
For Herds With Last Test Day in July and August 2006

Expected Monetary Value Difference Between Current and Expected 21-day PR



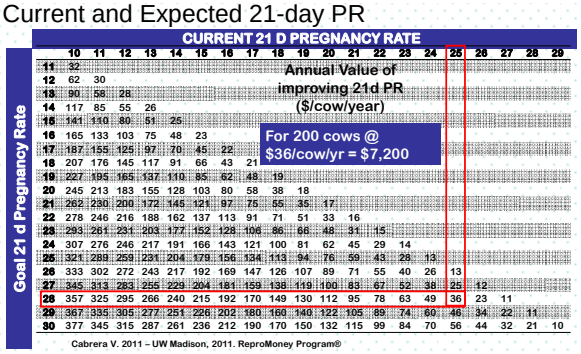
Cabrera V. 2011 – UW Madison, 2011. ReproMoney Program®

Expected Monetary Value Difference Between Current and Expected 21-day PR



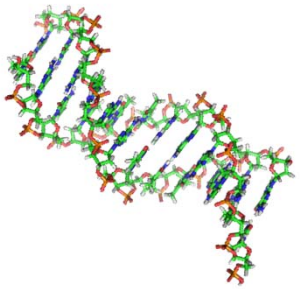
Cabrera V. 2011 – UW Madison, 2011. ReproMoney Program®

Expected Monetary Value Difference Between Current and Expected 21-day PR



Cabrera V. 2011 – UW Madison, 2011. ReproMoney Program®

Genomics



Variety of Chips

- 3K panel at $40/test.
- 50K panel at $150/test.
- 750K panel at $300/test.

Clarifide – Zoetis

Igenity - Neogen

Genomic Evaluation Reference Population

	Proven Sires	Cows	Heifers
Holstein	28,806	192,982	631,356
Jersey	4,684	42,962	64,427
Brown Swiss	6,333	1,692	2,364
Ayrshire	733	152	3,194
Guernsey	521	516	

YOUR SUCCESS Our Passion.

Accuracy of Genomic Evaluations

Genomic and Traditional Evaluations compared to Progeny Proofs

Milk	# of Bulls	Correlation 4/12 12/15 gPA to DYD	Correlation 4/12 12/15 PA to DYD
Holstein	3,837	.75	.49
Jersey	484	.79	.65

YOUR SUCCESS Our Passion.

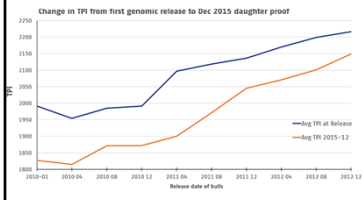
Accuracy of Genomic Evaluations

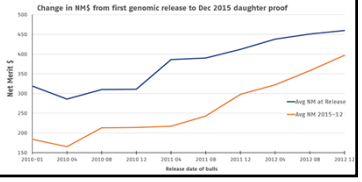
Genomic Prediction compared to Progeny Performance (2,915 Holstein Sires w/ ≥ 100 PL Daughters)

	SCS	PL
Correlation 4/12 12/15 gPTA to DYD	0.73	0.44

YOUR SUCCESS Our Passion.

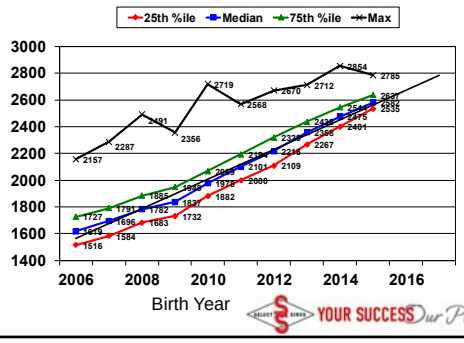
Change in TPI and NM$ from Genomic Release to Proof





Holstein TPI Trend

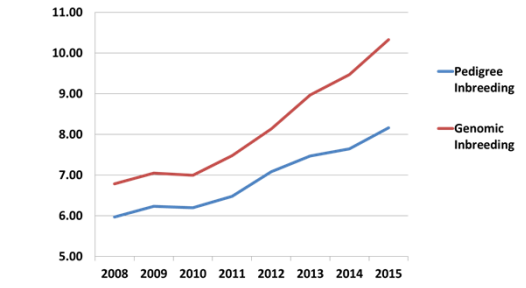
(All Major AI Organizations)



YOUR SUCCESS Our Passion.

Inbreeding Trend for Holstein/Red & White Young Sires

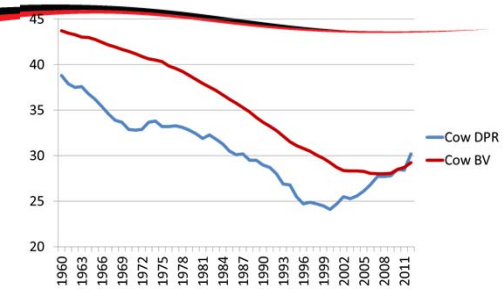
by Birth Year



Source: Council on Dairy Cattle Breeding – December 2015

YOUR SUCCESS Our Passion.

U.S. Holstein Actual and Genetic Trend for DPR



USDA, CDCB April, 2015

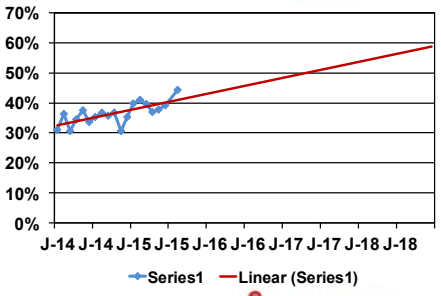
YOUR SUCCESS Our Passion.

Dairy Bulls Sampled (Select Sires) 2015

Breed	Bulls
B&W Holstein (US)	229
B&W Holstein (Canada)	38
Polled Holstein	12
Red Holstein	5
Showcase Holstein	2
Jersey – Select Sires	53
Jersey – River Valley	7
Ayrshire	4
Brown Swiss	8
Guernsey	3
Total	**361**

YOUR SUCCESS Our Passion.

Holstein Young Sire Sales–Select Sires



YOUR SUCCESS Our Passion.

Genetic Haploptypes

Name	Haplotype frequency	Timing of pregnancy loss
HH1	4.5 percent	All stages
HH2	4.6 percent	Before Day 100
HH3	4.7 percent	Before Day 60
HH4	0.7 percent	Unknown
HH5	4.8 percent	Before Day 60
JH1	23.4 percent	Before Day 60
BH1	14.0 percent	Before Day 100
BH2	20.5 percent	Stillborn Calves
AH1	26.1 percent	Unknown

YOUR SUCCESS Our Passion.

New Technologies

Select Reproductive Solutions

Synchronization Protocols

Pre-Synch 14/12
Lut-Ovsynch
PG 6-day CIDR
5-day CO-Synch + CIDR
Double Ovsynch
Ovsynch
7-day CIDR
7-day CO-Synch + CIDR
G – 6 - G
OvSynch 56
MGA - PG
14-day CIDR
Pre-Synch + CIDR
CO-Synch 72
SelectSynch + CIDR
Targeted Breeding

YOUR SUCCESS Our Passion.

So…which one do YOU pick?

- **DON'T GET CAUGHT UP IN THE "SYNCHRONIZATION OF THE MONTH CLUB"**
- **USE PROTOCOLS THAT ARE AGREED ON BY A GROUP OF EXPERTS**

DCRC
DAIRY CATTLE REPRODUCTION COUNCIL

http://www.dcrcouncil.org/

Beef Reproduction Task Force

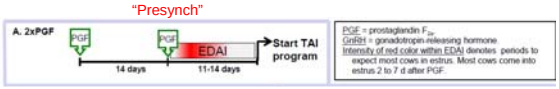
http://beefrepro.unl.edu/

Dairy Cow Protocols

Presynchronization methods used before Timed AI

*Used with Ovsynch programs (listed below) to increase pregnancies per AI (**P/AI**). Programs can be used with or without estrous detection and AI (**EDAI**).*

"Presynch"



DCRC
DAIRY CATTLE REPRODUCTION COUNCIL

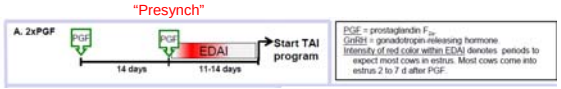
YOUR SUCCESS Our Passion.

Dairy Cow Protocols

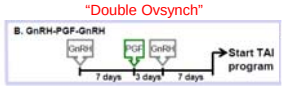
Presynchronization methods used before Timed AI

*Used with Ovsynch programs (listed below) to increase pregnancies per AI (**P/AI**). Programs can be used with or without estrous detection and AI (**EDAI**).*

"Presynch"



"Double Ovsynch"



DCRC
DAIRY CATTLE REPRODUCTION COUNCIL

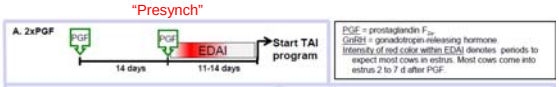
YOUR SUCCESS Our Passion.

Dairy Cow Protocols

Presynchronization methods used before Timed AI

*Used with Ovsynch programs (listed below) to increase pregnancies per AI (**P/AI**). Programs can be used with or without estrous detection and AI (**EDAI**).*

"Presynch"



"Double Ovsynch"

"G-6-G"

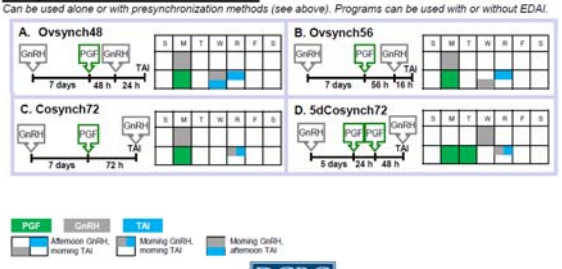
DCRC
DAIRY CATTLE REPRODUCTION COUNCIL

YOUR SUCCESS Our Passion.

Dairy Cow Protocols

Ovsynch methods used for TAI

Can be used alone or with presynchronization methods (see above). Programs can be used with or without EDAI.



DCRC
DAIRY CATTLE REPRODUCTION COUNCIL

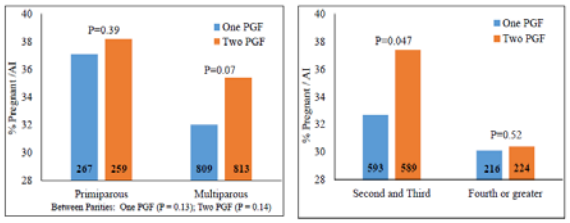
YOUR SUCCESS Our Passion.

Double Prostaglandin During Ovsynch

•11 commercial dairies in different locations in the USA: three in WI, three in CA, two in NY, one in PA, one in NM, and one in TX

GnRH	PGF	PGF	GnRH	AI
day 0	day 7	24h	56h	16h
50±3 DIM				

Double Prostaglandin During Ovsynch

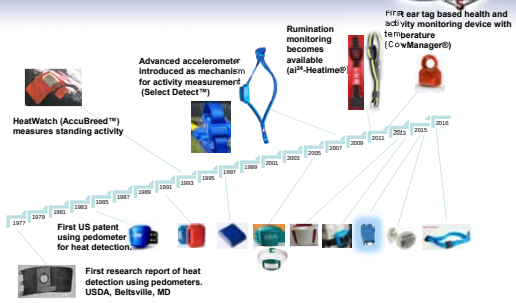


Double Prostaglandin During Ovsynch

		P/AI (%)	
Herd	n	*1 PG*	*2 PG*
CA -01	173	29	36
CA -02	235	35	40
CA -03	263	30	34
NM-04	368	35	38
NY – 05	207	33	31
NY – 06*	192	29	42
PA – 07	141	39	44
TX – 08	246	38	30
WI – 09	114	28	40
WI - 10	105	35	37
WI – 11	104	27	27
OVERALL*	**2,148**	**33**	**36**

* PG treatments differ within group, P < 0.07
J. Anim. Sci. Vol. 93, Suppl. s3/J. Dairy Sci. Vol. 98, Suppl. 2:2015

Activity Systems Timeline



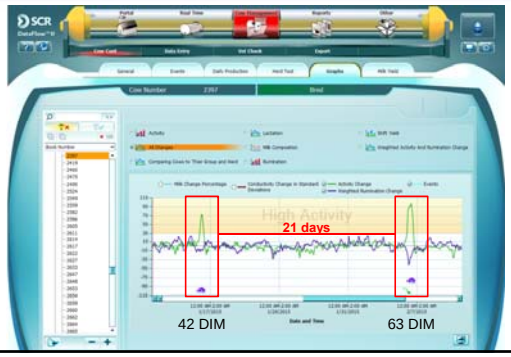
Currently Available Systems

System	Company	Location	Activity	Rumination	Cloud/Web
AccuBreed	Estrotect	Rump	✓		
AfiAct II	Afimilk	Ankle	✓		✓
CowAlert	IceRobotics	Ankle	✓		✓
CowManager	Agis	Ear	✓	✓	✓
CowScout 1 S	GEA	Ankle, neck	✓	Eating bouts	
DeLaval	DeLaval	Ankle	✓		
HeatPhone	Medria	Ankle	✓	✓	✓
RealTime+	Boumatic	Ankle, neck	✓	Eating bouts	
Heatime/ai²⁴	SCR	Neck	✓	✓	✓
MooMonitor+	Dairymaster	Neck	✓	✓	✓
Silent Herdsman	Embedded Technology Solutions	Neck	✓	✓	✓
SMARTBOW	MKW electronics	Ear	✓	✓	✓
Track a Cow	ENGS	Ankle	✓	Eating bouts	

Heatime® or ai²⁴

- SCR Heatime® from Netanya, Israel introduced the first-ever rumination monitoring tag – the SCR Heatime HR tag.
- Sold in North America by Select Sires, Genex, SCR, Semex, and MicroDairy
- Initial system required Infrared data transfer via a portal usually either entering or exiting the milking parlor.
- Radio frequency data transfer was first available January 2013
- Monitor's unique technology includes a specially tuned microphone that detects and records rumination.
- Proprietary movement sensor that uses fluid dynamics to detect changes in activity.

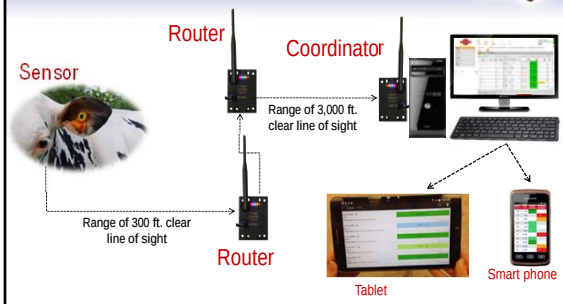
Heat Detection: Activity and Rumination



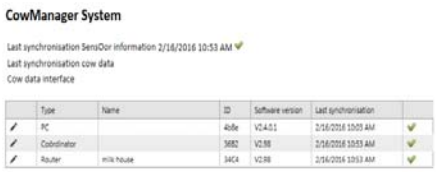
CowManager

- Developed by Agis Automatisering (Harmelen, Netherlands) and exclusively sold and serviced in North America by Select Sires
- It is the first health and activity monitor that is not an ankle pedometer or collar based system.
- Monitors cow welfare; activity, rumination, eating, resting, and temperature.
- Contains three modules: Fertility, Health, and Nutrition and allows producers to purchase any combination of modules.
- Alerts can be viewed via the web application on your personal computer or as an App on an android phone or tablet.

Communication scheme



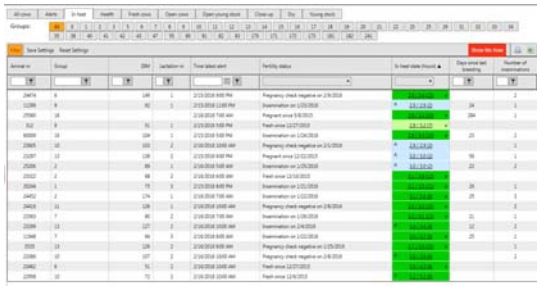
System Configuration



System Configuration

Three Modules

Fertility - Dashboard

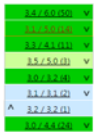


Heat Detection: Activity and Rumination

Fertility

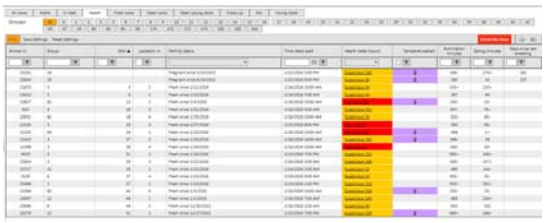
Type of alert

The arrow which is pointing up or down indicates if the cow is coming in heat and the level of high activity is increasing or, when the arrow is pointing down it indicates the cow is going out of heat and the level of high activity is decreasing.



Light blue - first two hours of activity, wait for more information
Light green - suspect heat, check interval and secondary signs
Dark green - high probability the cow is in heat

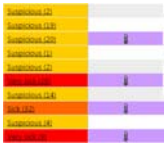
CowManager – Behavior Dashboard



Health

Cow list
- Health alert
- Ear temperature

Temperature is shaded purple if 7 degrees lower than the average



Type of alert
Suspicious – decreased or moderately impaired rumination
Sick – much less active with greatly reduced rumination
Very Sick – seriously reduced activity and rumination

CowManager – Ear Temperature

Health Alerts

Rumination

Eating

Eating bouts

Resting/Non-Active

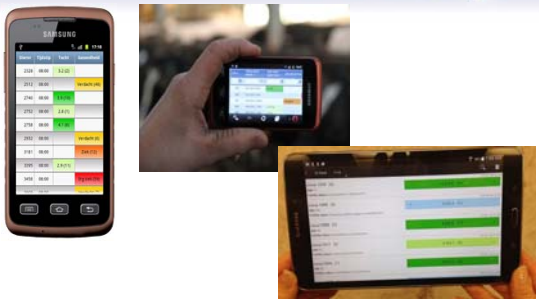
Laying/Standing bouts

Temperature

Conductivity

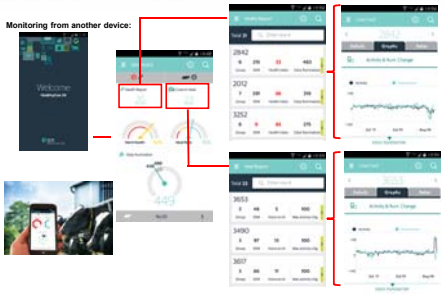
Rumen pH

Smartphone App



Free CowManager – App in the Google Store

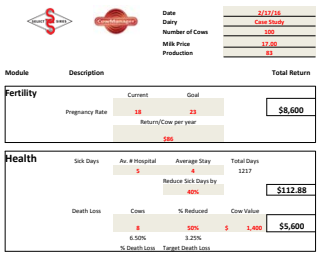
SCR HealthCow24 – App



Case Study – 100 Cows

# SensOor Tags	100	
Fertility	$80.30 ea	$8,030
Health	$ 42.90ea	$4,290
Routers (1)	$660 ea	$660
Coordinator	$726 ea	$726
Blank Tags (150)	$1.75 ea	$263
Shipping		$300
TOTAL INVESTMENT		$14,269

Case Study – 100 Cows



Annual Return: $14,313 Return versus $14,269 12 month ROI

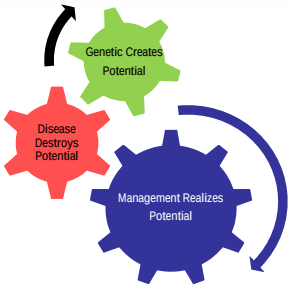
Economic Cost of Health Events

Milk Fever	$234.00
Ketosis	$181.00
Sub-clinical Ketosis	$69.00
Retained Placentas	$259.00
Metritis	$329.00
Displaced Abomasum	$391.00
Fresh Cow Mastitis (<30 DIM)	$208.00
Total Mastitis	$208.00
Indigestion	$100.00
Lameness	$360.00

"Sources: (1)The costs of common diseases of Dairy Cattle (proceedings) by: Charles Guard DVM CVC in Kansas City Proceedings - (2) Metritis Costs Us A Bundle by: Michael Overton, D.V.M. and John Fetrow, V.M.D. Article in Hoard's Dairyman - (3) Using Peak and Summit Milk to Evaluate Your Dairy's Management Programs By: Donna M. Amaral-Phillips, Ph.D University of Kentucky College of Agriculture - (4) Based on information from the National Mastitis Council website

VelPhone – Calving

Health is the new Fertility



Take Home Message

- Advanced affordable computer technology
- Individual cow management
- Many improvements and new systems have evolved over the last 3 years
- Animal well-being is the industry buzzword and systems that measure rumination give excellent insight into health monitoring

Normal Ranges

Key Performance Indicator		Normal Range low	Normal Range high	Comment
% pregnant by 150 DIM		60	75	% of all pregnant cows
% open after 270 DIM		8	5	% of all cows >270 DIM
% pregnant		45	55	
DIMFB		-	-	DIM at first breeding, herd dependent
VWP		-	-	DIM when 5% of inseminations are complete, herd dependent
1st lactation	Submission Rate (%)	60	68	
	Conception Rate (%)	35	40	
	Pregnancy Rate (%)	20	25	
2nd lactation	Submission Rate (%)	60	68	
	Conception Rate (%)	34	38	
	Pregnancy Rate (%)	18	23	
+3rd lactation	Submission Rate (%)	57	65	
	Conception Rate (%)	32	36	
	Pregnancy Rate (%)	16	21	
heifers	Submission Rate (%)	60	75	
	Conception Rate (%)	50	65	
	Pregnancy Rate (%)	30	40	
heifers*	Conception Rate (%)	38	48	*Sexed semen usage at 100%