

Understanding & Managing Somatic Cell Counts To Improve Milk Quality



P.L. Ruegg, DVM, MPVM
University of Wisconsin, Madison



What is Mastitis?

- Bacterial infection of the udder
- 99% occurs when bacterial exposure at teat end exceeds ability of immune defenses of cow
- Subclinical mastitis
 - Milk appears normal but contains excessive numbers of inflammatory cells
 - This milk can be sold for human consumption
- Clinical mastitis
 - Visual abnormalities of milk
 - Cannot be sold for human consumption



Somatic Cells in Milk Indicate the Presence of Cows with Subclinical Mastitis Infections



There is no way to know how many cows are infected without performing an individual cow SCC test



Somatic Cells are NOT Affected by:

- Breed
 - Milk yield
 - Unless <7 kg/cow/day
 - Stage of lactation
 - Unless there are more infected cows in later lactation
 - Nutritional management
 - Unless diet results in very loose feces and dirtier cows
 - Other cow diseases
- 

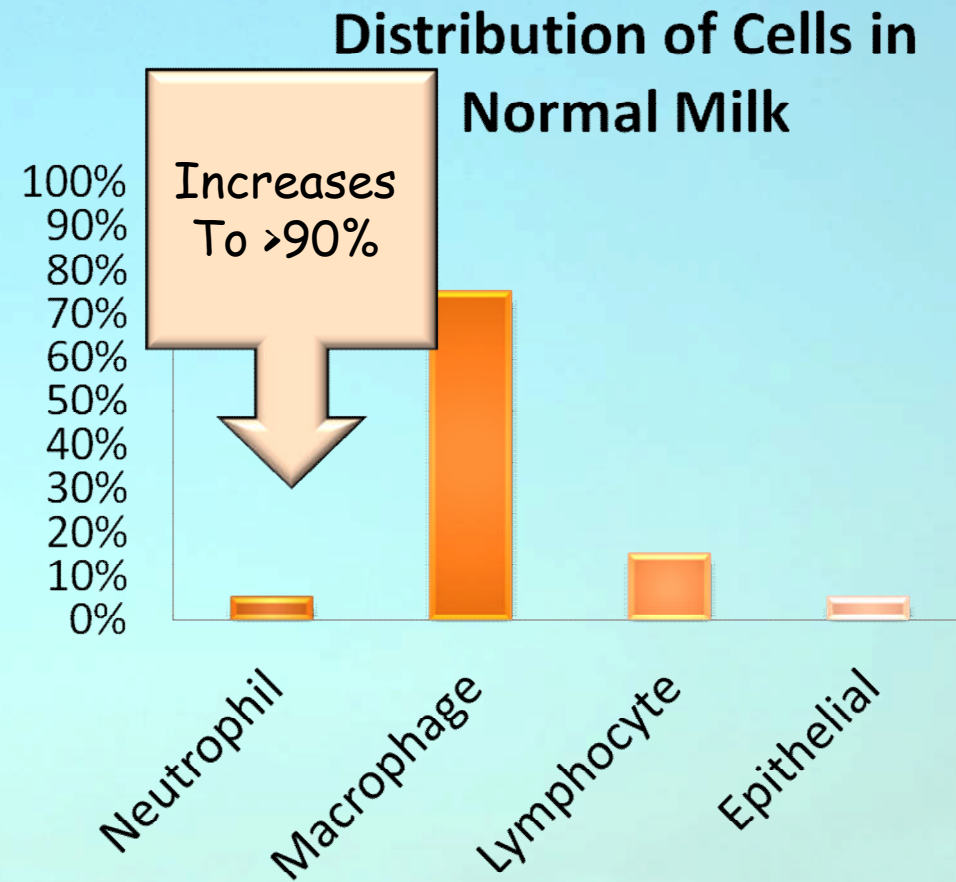
Somatic Cell Count Are Affected by

- Management practices that expose teats to bacteria that cause mastitis
 - In **milk** that came from infected udders of cows
 - Exposure to contagious bacteria
 - In the **environment** that the cow lives in
 - Exposure to environmental bacteria

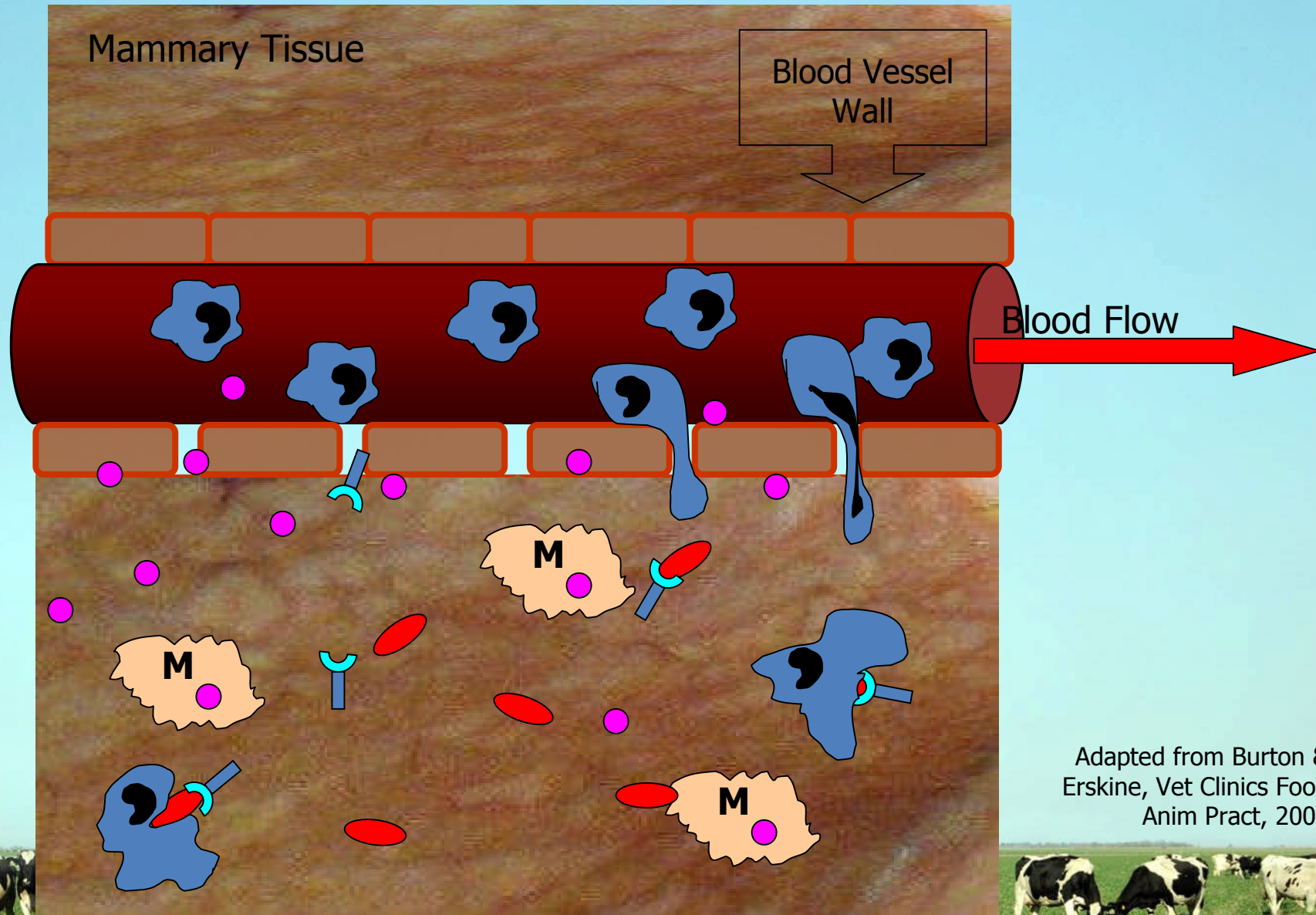


Somatic Cells in Milk

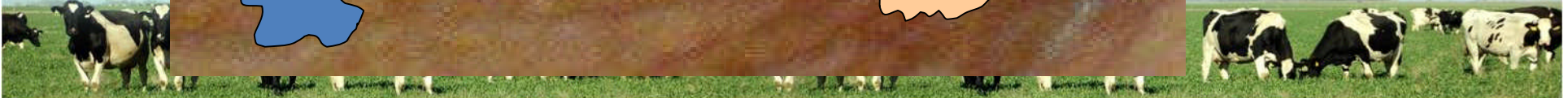
- SCC composed of white blood cells & occasional dead epithelial cells
- Macrophages are predominant cell in uninfected gland
 - Provide surveillance & initiate inflammatory response
- 90% of SCC in infected gland are neutrophils



How Somatic Cells Get into Milk



Adapted from Burton & Erskine, Vet Clinics Food Anim Pract, 2003



When the SCC is High Does it Mean that you can find bacteria in the milk?

	Prevalence of IMI or High SCC			Quarter Status		
	Dry Off	Calving	First Test	Chronic	New	“Cured”
Bacteriology positive	13%	7%	9%	10%	7%	90%
Quarter SCC >200k	37%	19%	11%	26%	16%	75%



Mastitis is Based on Detection of Inflammation **NOT INFECTION**

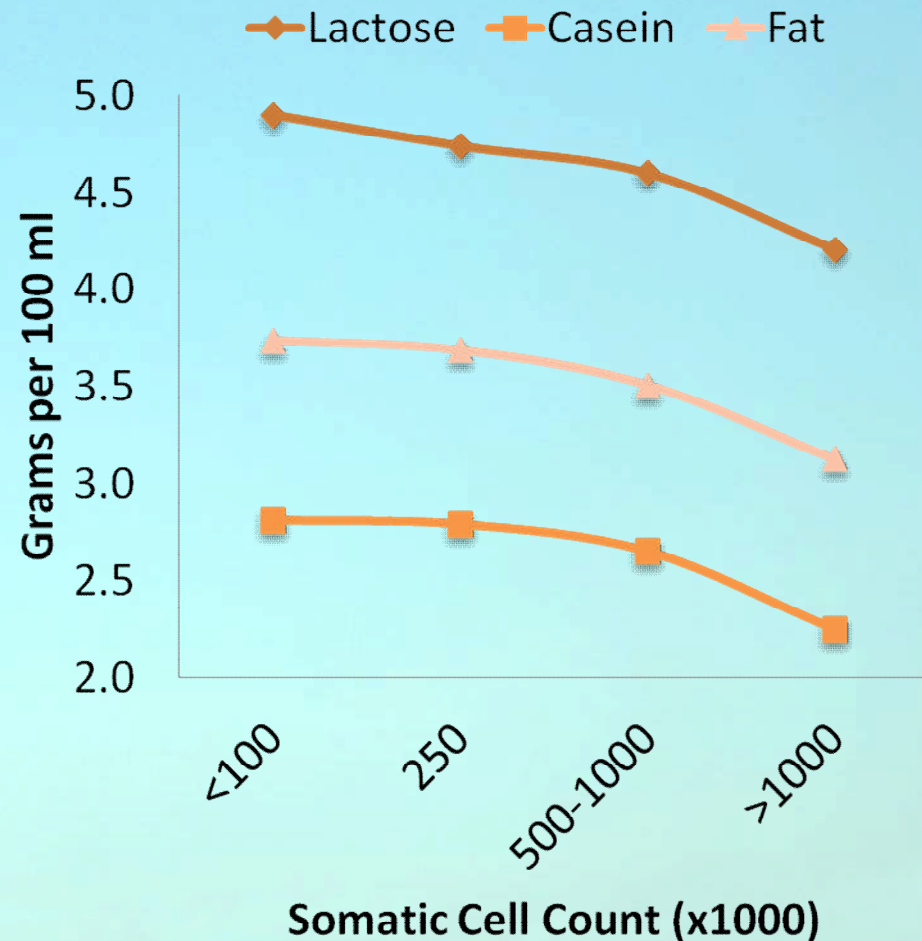


We are detecting the Results of the Immune Response!

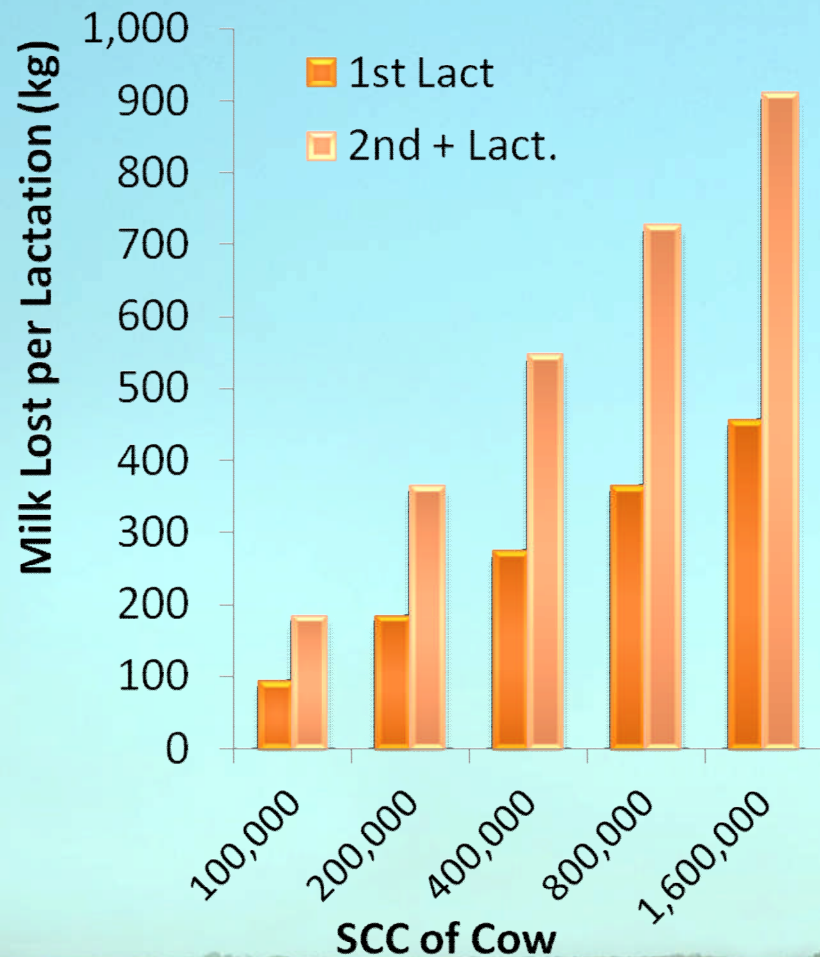


SCC and Product Quality

- Injury to secretory cells reduces synthesis of lactose, fat & protein
- Increased permeability of cell membranes allows leakage of blood components into milk
- Reduced shelf life



SCC and Annual Milk Yield Loss



- \$\$\$ Loss for 100 cows
 - 30% 1st lactation
 - \$0.33 per liter
- SCC of 200,000
 - \$10,200 per year
- SCC of 400,000
 - \$15,300 per yearop

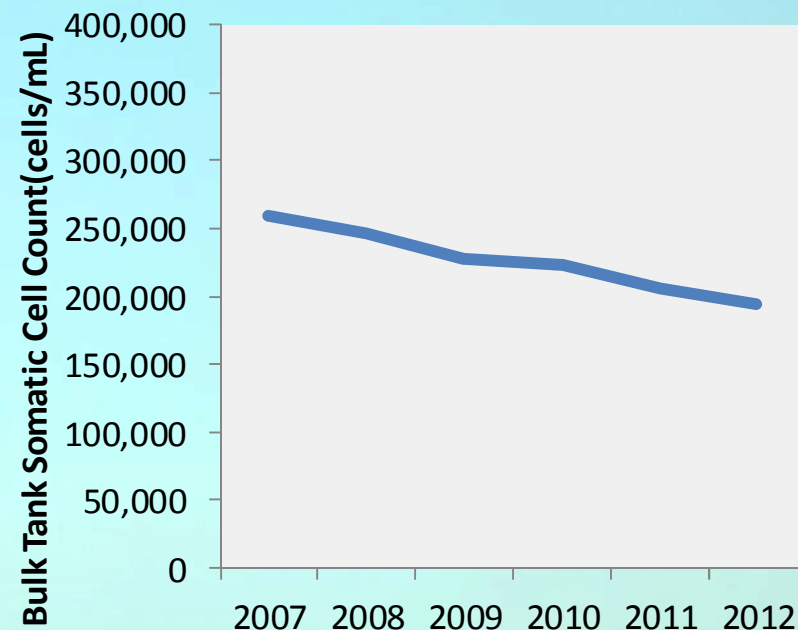
Raubertas & Shook, 1981



International Quality Standards

- Globalization has driven changes in milk quality
- National regulatory standards are less important than requirements of export market
- Processors drive change to meet those requirements
 - $<400,000$ cells/mL is global standard

Average Bulk Tank SCC
Wisconsin Dairy Farms



Change is Driven by Processors

Data on every tank leaving farm

Daily Test Results - Current Month
From: 9/1/09 to: 9/15/09
MPS101 - 01 Daily Test Results

SCC

LPC, E coli and SPC

Last Refreshed: 9/22/09 4:00:30 PM

Pickup	Start Fill	End Fill	Arrive	Intake	Tank	Temp	Fat %F	Prot	O Sol	SCC	O Coli	LPC	PPLC	O MUN	Pounds	Plant	Tanker	
Weighted Average:							3.59%	3.00%	5.77%	213				96%	9.74	50,606		
9/17/09	9/16/09 5:28 PM	9/16/09 11:00 PM	9/17/09 12:00 AM	1	39	3.56 %	2.98 %	5.79 %	220	N	70	170	2	N	9.75	45,320	FRANDE - BVILLE	1049-22
9/16/09	9/16/09 11:45 AM	9/16/09 5:28 PM	9/16/09 7:40 PM	1	38	3.50 %	2.98 %	5.76 %	232	N	80	130	3	N	9.65	50,720	FRANDE - BVILLE	1049-09
9/16/09	9/16/09 7:40 AM	9/16/09 11:45 AM	9/16/09 4:00 PM	1	38	3.56 %	2.93 %	5.79 %	135	N	0	100	2	N	9.37	49,920	FRANDE - BVILLE	1049-23
9/16/09	9/16/09 2:25 AM	9/16/09 7:40 AM	9/16/09 9:45 AM	1	39	3.50 %	2.89 %	5.79 %	199	N	70	180	4	N	10.22	50,480	FRANDE - BVILLE	1049-13
9/16/09	9/15/09 10:20 PM	9/16/09 2:25 AM	9/16/09 4:30 AM	1	39	3.73 %	3.01 %	5.79 %	164	N	30	70	3	N	9.83	51,040	FRANDE - BVILLE	1049-12
9/16/09	9/15/09 5:10 PM		9/16/09 1:30 AM	1	39	3.47 %	2.99 %	5.80 %	216	N	140	60	2	N	11.52	50,560	FRANDE - BVILLE	1049-09
9/15/09	9/15/09 11:22 AM	9/15/09 5:10 PM	9/15/09 8:15 PM	1	40	3.62 %	3.01 %	5.76 %	280	N	100	150	0	N	10.75	50,220	FRANDE - BVILLE	1049-19
9/15/09	9/15/09 7:20 AM	9/15/09 11:22 AM	9/15/09 3:30 PM	1	39	3.53 %	2.90 %	5.77 %	140	N	10	60	0	N	10.40	51,360	FRANDE - BVILLE	1049-22
9/15/09	9/15/09 2:00 AM	9/15/09 7:20 AM	9/15/09 11:00 AM	1	39	3.40 %	2.94 %	5.77 %	216	N	0	180	2	N	11.03	50,820	FRANDE - BVILLE	1049-12
9/15/09	9/14/09 8:45 PM	9/15/09 2:00 AM	9/15/09 10:35 AM	1	39	3.67 %	3.08 %	5.77 %	176	N	0	130	2	N	10.89	50,140	FRANDE - BVILLE	1049-09
9/15/09	9/14/09 4:45 PM	9/14/09 8:45 PM	9/15/09 6:00 AM	1	39	3.46 %	3.07 %	5.78 %	210	N	50	180	7	N	10.77	49,120	FRANDE - BVILLE	1049-19
9/14/09		9/14/09 11:03 AM	9/14/09 4:19 PM	1	38	3.53 %	2.91 %	5.75 %	122	Y	20	100	4	Y	10.87	50,660	FRANDE - BVILLE	1049-14
9/14/09	9/14/09 11:03 AM	9/14/09 4:45 PM	9/14/09 9:15 PM	1	39	3.56 %	3.06 %	5.74 %	286	N	200	220	2	N	11.25	50,600	FRANDE - BVILLE	1049-22
9/14/09	9/14/09 1:40 AM	9/14/09 6:47 AM	9/14/09 10:48 AM	1	39	3.51 %	2.99 %	5.77 %	198	N	80	220	1	N	11.14	50,640	FRANDE - BVILLE	1049-23
9/14/09	9/13/09 8:20 PM	9/14/09 1:40 AM	9/14/09 7:30 AM	1	39	3.69 %	3.11 %	5.73 %	211	N	300	120	6	N	10.27	50,160	FRANDE - BVILLE	1049-18
9/13/09	9/13/09 4:10 PM		9/13/09 10:45 PM	1	39	3.52 %	3.07 %	5.78 %	177	N	300	160	145	N	10.31	50,560	FRANDE - BVILLE	1049-19
9/13/09	9/13/09 11:00 AM	9/13/09 4:10 PM	9/13/09 5:30 PM	1	39	3.59 %	3.07 %	5.73 %	267	N	200	170	3	N	10.78	45,960	FRANDE - BVILLE	1049-09
9/13/09	9/13/09 7:06 AM	9/13/09 11:00 AM	9/13/09 1:45 PM	1	39	3.58 %	2.94 %	5.74 %	136	N	300	50	3	N	10.46	50,520	FRANDE - BVILLE	1049-14
9/13/09	9/13/09 1:35 AM	9/13/09 7:06 AM	9/13/09 12:15 PM	1	40	3.51 %	3.00 %	5.76 %	195	N	300	70	2	N	11.14	50,720	FRANDE - BVILLE	1049-23
9/13/09	9/12/09 9:40 PM	9/13/09 1:35 AM	9/13/09 7:00 AM	1	39	3.72 %	3.10 %	5.74 %	177	N	100	40	3	N	9.45	50,640	FRANDE - BVILLE	1049-18
9/12/09	9/12/09 4:10 PM	9/12/09 8:30 PM	9/12/09 10:30 PM	1	39	3.57 %	3.01 %	5.68 %	195	N	300	100	5	N	10.53	49,560	FRANDE - BVILLE	1049-09
9/12/09	9/12/09 11:00 AM	9/12/09 4:10 PM	9/12/09 5:30 PM	1	38	3.63 %	3.07 %	5.74 %	264	N	50	130	3	N	10.61	49,280	FRANDE - BVILLE	1049-13
9/12/09	9/12/09 7:05 AM	9/12/09 11:00 AM	9/12/09 1:35 PM	1	39	3.56 %	2.95 %	5.77 %	136	N	300	70	3	N	10.34	50,700	FRANDE - BVILLE	1049-12
9/12/09	9/12/09 1:45 AM	9/12/09 7:05 AM	9/12/09 9:45 AM	1	39	3.51 %	3.01 %	5.77 %	217	N	300	80	3	N	10.08	50,600	FRANDE - BVILLE	1049-18
9/12/09	9/11/09 8:19 PM	9/12/09 1:45 AM	9/12/09 4:30 AM	1	39	3.78 %	3.12 %	5.76 %	212	N	10	300	3	N	9.46	50,640	FRANDE - BVILLE	1049-09
9/12/09	9/11/09 4:15 PM	9/11/09 8:19 PM		1	39	3.62 %	3.08 %	5.79 %	188	N	60	100	2	N	9.87	51,220	FRANDE - BVILLE	1049-13
9/11/09	9/11/09 11:05 AM	9/11/09 4:15 PM		1	40	3.63 %	3.03 %	5.73 %	273	N			4	N	10.01	50,740	FRANDE - BVILLE	1049-22
9/11/09	9/11/09 7:00 AM	9/11/09 11:05 AM	9/11/09 12:15 PM	1	38	3.64 %	2.90 %	5.74 %	162	N			3	N	10.04	50,460	FRANDE - BVILLE	1049-14
9/11/09	9/11/09 2:00 AM	9/11/09 7:00 AM	9/11/09 10:01 AM	1	39	3.63 %	2.97 %	5.78 %	223	N			2	N	9.00	50,680	FRANDE - BVILLE	1049-09
Weighted Average:							3.59%	3.00%	5.77%	213				9.74	50,606			

Total: 5,313,671

SCC of Milk from Healthy Udders is Low and Consistent

- SCC from uninfected SCC of 2 Quarters of 1
1,600

Cows with SCC >200,000 cells/ml have 1 or more quarters with subclinical mastitis
Heifers should be <100,000

Axis Title

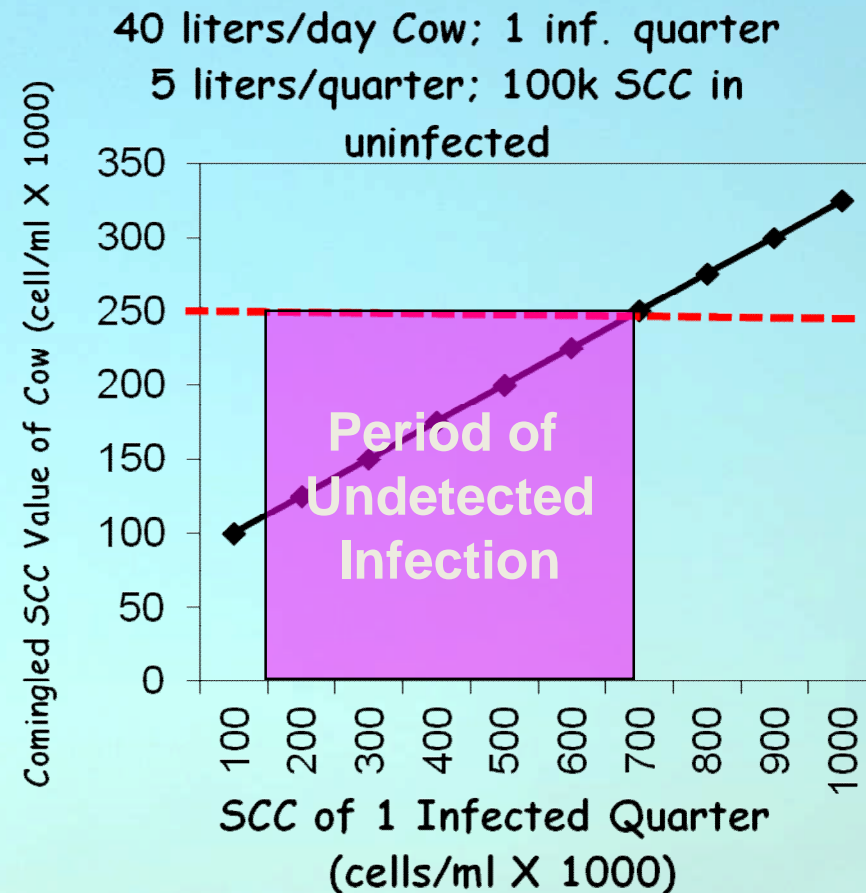
■ Infected Quarter ● Healthy Quarter



Harmon, JDS 1994

Somatic Cell Count DHIA Thresholds

- Individual cow SCC values are comingled milk from all 4 quarters
- The SCC of a cow with a SINGLE infected quarter may be quite low
 - Causes variation in SCC values



Key Performance Indicators

Subclinical Mastitis

Indicator	Calculation <small>(based on monthly tests)</small>	Goal
Prevalence (proportion of currently affected)	Number of cows with SCC>200,000 cells/ml/number of cows with SCC	<15% of lactating cows
Incidence (new infections)	Number of cows with SCC>200,000cells/ml for the first time in the time period/number of cows with SCC below 200,000 in previous time period	<5% if determined based on 1 st SCC>200k in the lactation up to 8% if based on month to month changes in SCC
Prevalence at 1 st DHIA test	Number of cows with SCC>200,000 cells/ml at 1 st monthly test/number of cows with 1 st SCC tests	<5% of 1 st lactation <10% of lactation 2+
Prevalence at last DHIA test before dry off	Number of cows with SCC>200,000 cells/ml at last test before dry off/number of cows with last DHIA test	<30% of cows with last test date SCC

Identification of Subclinical Infections

A history of SCC is more informative than

Mastitis Cannot be Managed without Individual SCC Values for Cows

BARN N																		
LINN																		
KITK	8	5.6	\$205	D	8.1	5.7	5.2	5.9	4.8	4.5	4.8	5.5	580	409	523	1703	DRY	323
KRUNCH	23	5.2	\$183	D	D		NA	D	D	D	D	D	D	D	D	D	DRY	75

Chronic Infection



Practical Methods to Improve Milk Bulk Tank SCC

1. Work with advisors to implement an annual udder health plan
2. Focus on prevention of new infection
 - NOT treatment after infection occurs
3. Identify and manage chronically infected COWS

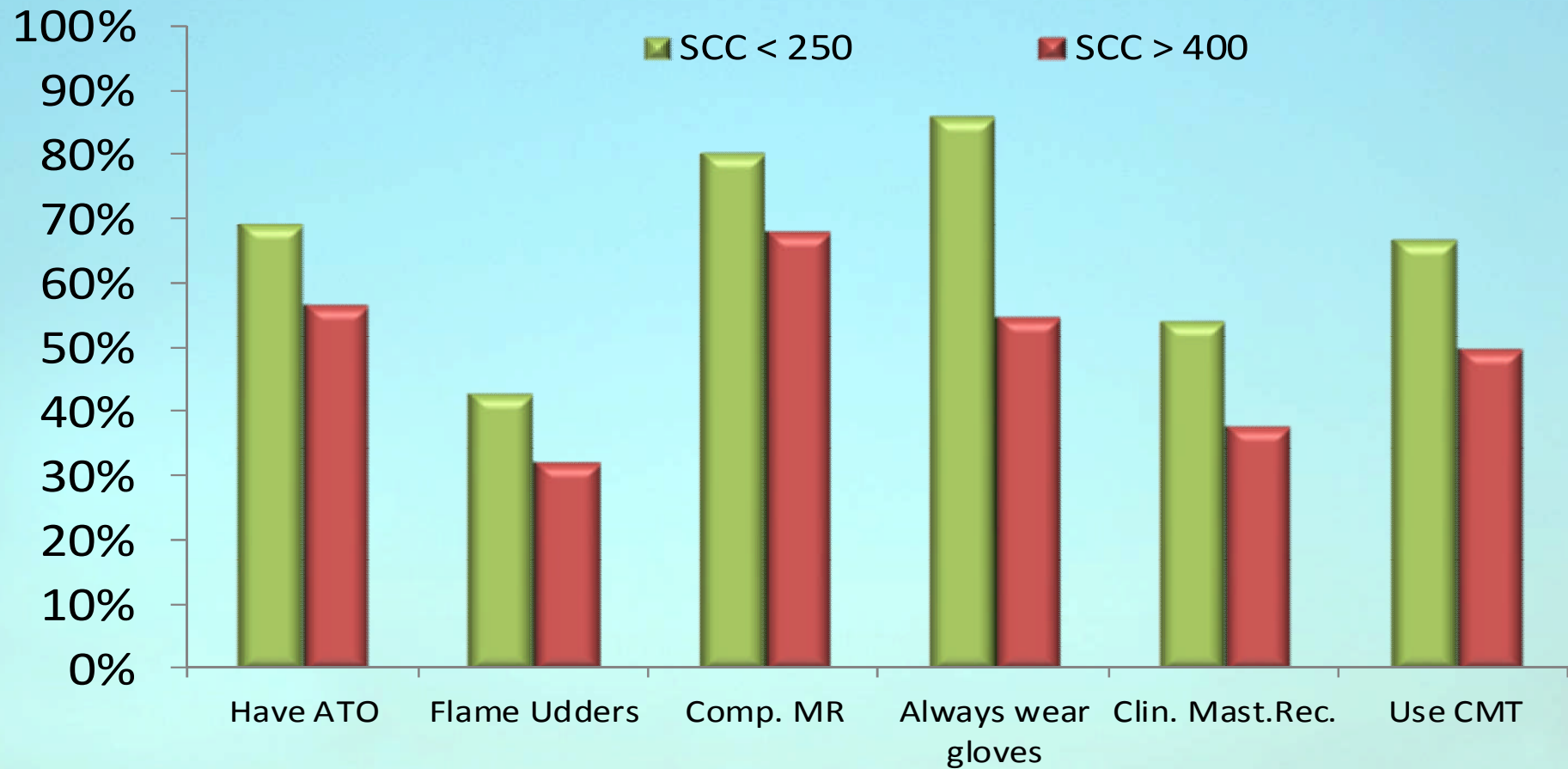


Make an Annual Udder Health Plan

- Identify a farm management team of advisors to help solve the problem
- Have a monthly meeting of the advisors to focus specifically on SCC
- Develop
 - Goals for SCC
 - Actions & ways to assess the actions
 - Responsibilities for each team member
 - Target Dates to complete the actions
 - Times to meet to evaluate progress



In Wisconsin, Producers who adopt more recommended practices produce higher quality milk



Rodrigues and Ruegg, 2004 JDS



In Sicily: Herds that Adopt more Best Management Practices Produce Better Quality Milk

Data From Herds at Beginning of CoRFiLac Milk Quality Program

100%

Mastitis Control is a Result of the Cumulative Effect of Adopting Best Management Practices

Forestrip

Purchase Heifers

USE DCT

Wear Milking gloves

PostDip OK

Use Predip

Train Milkers




Successful Implementation of the 5 Pt Plan

1. Effective teat dipping
 1. 97% of farms dip but many do not dip effectively
2. Dry cow therapy of all quarters of all cows
 - To treat subclinical infections present at dry off
3. Appropriate treatment of clinical cases
 - Record all cases
 - Monitor outcomes
4. Culling chronically infected COWS
5. Regular milking machine maintenance
 1. Stable teat end vacuum



Reducing BTSCC
is Based on
Finding Infected
Cows and
Making
Decisions about
their Futures



A close-up photograph of a cow's udder during milking. A milking machine is attached to the teats. The udder skin appears slightly reddened and irritated, particularly around the teats, which is characteristic of chronic mastitis. The background shows the cow's body and the milking parlor environment.

Options for Handling Chronic Mastitis

**Treat, Segregate, Dry off Cow,
Dry off quarter, Quarter milk or Cull**

Solving Mastitis Problems

- Technically easy
 - Keep bacteria away from teats
- Find the infected cows
 - Decide what to do with them
 - Treat them or EAT them
- Determine why they get infected
 - What is the source of infection
 - Other cows or environment?
- Decide how to stop new infections
 - What management changes need to occur?



- Herds can achieve improved BTSCC by adopting recommended best management practices
- Key to improved BTSCC is to
 - Know which cows are infected with subclinical mastitis
 - Prevent new infections
 - Work with a team to implement change

