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COOPERATIVE EXTENSION SERVICE
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MASTITIS AND ITS CONTROL

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OUTLINE OF TOPICS

1. ***Mastitis: The Problem and its Cost***
   - *Definitions of mastitis terms*
   - *Economics of mastitis, losses and returns from control program*
   - *Returns from milk quality premiums*
   - *Targeting and eliminating the culprits*
     - *Comparison of bulk tank SCC and DHIA-SCC score*
     - *Effect of culling cows on bulk tank SCC*
   - *Estimating milk production loss from mastitis by different somatic cell count measurements in milk*

2. ***Understanding Contagious and Environmental Mastitis***
   - *Causes, source, indicators of problem, control methods, and goals*

3. ***Controlling Contagious Mastitis***
   - *Bacteria involved*
   - *Preventing new infections*
   - *Eliminating existing infections*
   - *Summary of methods to control contagious mastitis and lower somatic cell count*

4. ***Characteristics of Environmental Mastitis***
   - *Source of environmental bacteria*
   - *Risk of infections*
   - *Rate of clinical mastitis*
   - *Cost of clinical mastitis*
   - *Somatic cell counts*
   - *Duration of infections*
   - *Clinical symptoms*
   - *Prevalence of environmental infections*
   - *Herd monitoring methods*
   - *Treatment*

5. ***Controlling Environmental Mastitis***
   - *Prevention*
   - *Sources of environmental bacteria*
     - *The cow's environment*
     - *Bedding*
   - *Teat dipping*
   - *Dry cow therapy*
   - *Backflushing milker claws*
   - *Proper milking procedure*
   - *Predipping*
   - *Milking machine*
   - *Nutrition*
   - *Vaccines*

6. ***Mastitis Detection and Trouble Shooting Herd Problems***
   - *A table to help determine the cause of mastitis and the control procedures needed*

7. ***Using DHIA Somatic Cell Count Score in Mastitis Detection and Trouble Shooting Herd Problems***
   - *DHIA herd summary to determine extent of problem*
   - *Stage of lactation profile to determine causes of mastitis and control methods needed*
   - *Using individual cow DHIA-SCC scores*

8. ***Proper Milking Procedure***
   - *The National Mastitis Council recommended milking procedures*
   - *Predipping*
   - *Teat dip products*

9. ***Milking Machine Inspection and Maintenance Checklist***
   - *Dairy producer checks and recommended service*
   - *Equipment dealer checks and service*

10. ***Proper Treatment Procedures***
    - *Recommendation on proper method of infusing antibiotics into the mammary gland*

11. ***How to Collect Milk Samples for Identification of Mastitis Causing Bacteria***
    - *Recommendation on proper method of collecting milk samples for culturing*

1. MASTITIS: THE PROBLEM AND ITS COST

DEFINITIONS

Mastitis — *inflammation of the mammary gland.*

- *Cause — microorganisms, usually bacteria, that invade the udder, multiply, and produce toxins that are harmful to the mammary gland.*

Clinical mastitis — *visible signs of the disease*

- *mild signs — flakes or clots in the milk, may have slight swelling of infected quarter.*
- *severe signs — secretion abnormal, hot, swollen quarter or udder; cow may have a fever, rapid pulse, loss of appetite, dehydration and depression; death may occur.*

Subclinical mastitis — *no visible signs of the disease*

- *somatic cell count (SCC) of the milk will be elevated.*
- *bacteriological culturing of milk will detect bacteria in the milk.*
- *causes the greatest financial loss to dairy farmers through lowered milk production.*
- *for every clinical case of mastitis, there will be 15 to 40 sub-clinical cases.*

MASTITIS ECONOMICS

Table 1. Estimated annual losses due to mastitis

Source of loss	Loss per cow	% of total
Reduced production	$121.00	66.0
Discarded milk	10.45	5.7
Replacement Cost	41.73	22.6
Extra Labor	1.14	0.1
Treatment	7.36	4.1
Veterinary Services	2.72	1.5
TOTAL	$184.40	100.0

Assumptions: One-third of cows infected in an average of 1.5 quarters; milk loss 856 lb/infected quarter; milk price $12.07/cwt.

Source: *Current Concepts of Bovine Mastitis*. The National Mastitis Council (NMC), 1996.

Estimated losses from mastitis

- *$184 per cow*
- *$18,400 per 100 cow herd*
- *$28 million in Kentucky*
- *$1.7 billion in U.S.*

Somatic cell count (SCC) as an indicator of mastitis.

- *Somatic cell count is the number of leukocytes or white blood cells per milliliter of milk.*
- *Normal milk will have less than 200,000 cells per milliliter.*
- *Leukocytes or somatic cells enter the milk in increased numbers in response to injury.*
- *An elevated SCC is an indication of inflammation in the udder.*
- *Bulk tank SCC gives an indication of:*
  - *The level of sub-clinical mastitis*
  - *The loss in milk production in a herd due to mastitis*

Table 2. Estimated infection prevalence and losses in milk production associated with elevated bulk tank SCC

Bulk tank SCC (1,000's/ml)	Percent infected quarters in herd	Percent production loss*
200	6	0
500	16	6
1000	32	18
1500	48	29

* Production loss calculated as a percent of production expected at 200,000 cells/ml.

Source: *Current Concepts of Bovine Mastitis*. NMC, 1987.

Economics of mastitis control program

Economics of mastitis control program		
Field study:		
Production per cow (+1050 lb. @ $12 cwt)	=	$126.00
Clinical mastitis reduced 40%		
Discarded milk $24 x 40%	=	$10.00
TOTAL RETURN	=	$136.00
Mastitis control costs (per cow annually)		
Teat dip		$10.00
Dry cow medication		4.00
Paper towels		10.00
TOTAL COST		$24.00
Net Return to mastitis control (per cow annually)		$112.00

YIELD & DOLLAR LOSSES

Table 3. Use of DHIA somatic cell count (SCC) score to estimate production loss due to mastitis

Estimated change in lactation milk yield associated with an increase in DHIA somatic cell count score.

Lactation average SCC score	Lactation average SCC (thousands/ml)	Difference in milk yield* (lb/305 days)	
		Lactation 1	Lactation 2 or greater
0	12.5	——	——
1	25	——	——
2	50	——	——
3	100	200	400
4	200	400	800
5	400	600	1200
6	800	800	1600
7	1600	1000	2000

* Comparisons are with lactation yields at SCC scores of 2.

Source: *Current Concepts of Bovine Mastitis*. NMC, 1987.

Table 4 uses the DHIA SCC score to estimate the yearly cost of losses in milk production due to mastitis.

Table 4. Economic loss in milk production due to mastitis compared to a herd with a SCC score of 3

	Yearly Loss	
SCC score	**50 cow herd**	**100 cow herd**
3	—	—
4	$2,000	$4,000
5	$4,000	$8,000
6	$6,000	$12,000
7	$8,000	$16,000

Based on a herd with 30% first lactation animals and a milk price of $12.00/cwt.

Quality Premiums

Table 5. Dollar return per month in a 100 cow herd with quality premiums of $.10 to $.50/cwt and average lb of milk/cow/day from 30 to 70 lb.

		Quality Premium Return per 100 cows per month (30 days)				
Premium	$0.50	$450	$600	$750	$900	$1,050
per	$0.45	$405	$540	$675	$810	$945
cwt	$0.40	$360	$480	$600	$720	$840
milk	$0.35	$315	$420	$525	$630	$735
	$0.30	$270	$360	$450	$540	$630
	$0.25	$225	$300	$375	$450	$525
	$0.20	$180	$240	$300	$360	$420
	$0.15	$135	$180	$225	$270	$315
	$0.10	$90	$120	$150	$180	$210
Average lb. milk/cow/day		30	40	50	60	70

For example, a 100-cow herd averaging 50 lb milk/cow daily and receiving a $0.25/cwt premium would get $375 per month.

Estimated returns from a mastitis control program

Based on reduced DHIA-SCC Score Resulting in:

- *improved milk production*
- *quality premiums*

Example for a 100 cow herd

- *SCC score in the herd lowered by one point (for example: from a score of 5 to 4) = $4,000*
- *Receive quality premium of 25¢/cwt (average 50 lb milk/cow/day) = $4,500*

Annual return to 100 cow herd *$8,500*

Targeting and Eliminating the Culprits

The somatic cell count and level of production of individual cows influence the bulk tank SCC and the average DHIA SCC score in different ways. The bulk tank SCC is the average SCC of the milk in the bulk tank and a measure of milk quality. The DHIA score is the average SCC score for all cows in the herd. It represents the average mastitis situation in the herd. Generally, about half of the cows will be above the average DHIA SCC score and half below.

Tables 6, 7, and 8 and related discussion indicate the impact of high cell count cows on bulk tank SCC and DHIA SCC score. The effect of culling high count cows on these two measures can be seen in Tables 7 and 8.

Table 7 illustrates the effect of culling cows on bulk tank SCC and DHIA SCC-score. For example selling cow number 1 reduces the bulk tank SCC by 337,000 from 973,000 to 636,000 and the DHIA SCC score by 0.4 from 4.8 to 4.4 (converted cell count 340,000 to 260,000).

For example, culling a cow with a DHIA SCC score of 8 (3,200,000 SCC) that was producing 40 lb of milk a day would lower the bulk tank SCC by 42,276 cells in a 50 cow herd averaging 50 lb of milk per day (Table 8).

If a herd is not milking 50 lb/day, percent of production of the cow to be culled above or below herd average could be used. For example, if the cow to be culled is milking 20 percent below herd average, use the figures in the column under 40 lb of milk per day. If the cow is 20 percent above, use the 60 lb column; and if she is 40 percent above use the 70 lb column.

SCC and Related Milk Production Losses

Table 9 is provided as a quick reference to compare various measures of somatic cell count (SCC) level with ***estimated*** *losses in milk production due to sub-clinical mastitis. To estimate production losses a producer can use either California Mastitis Test (CMT), often called a paddle test; Wisconsin Mastitis (WMT); or actual SCC (bulk tank or DHIA) from individual cows or from bulk tank milk. Estimated milk loss is shown as percent milk loss for the entire herd or individual cows as well as the average pounds of production loss per cow per year.*

For individual cows, losses should be based on an average cell count for the lactation. For example, if a cow averages 400,000 SCC for the lactation, her milk loss from mastitis would be estimated at 8% or 1,200 pounds. Also, if the bulk tank SCC averaged 400,000 for the year, the estimated milk loss would be 8% for the herd or an average of 1200 pounds per cow.

Table 6. Bulk tank and DHIA SCC score comparison in a herd of 10 cows (each cow producing 50 lb of milk)

Cow No.	Cow SCC	Cow DHIA SCC score
1	4,000,000	8.3
2	3,000,000	7.9
3	1,500,000	6.9
4	400,000	5.0
5	250,000	4.3
6	200,000	4.0
7	150,000	3.6
8	100,000	3.0
9	75,000	2.6
10	50,000	2.0
Total Cows 10	**Bulk Tank Average SCC 973,000**	**DHIA SCC score average 4.8 (340,000 cells)**

Table 7. Impact of removing cows from the herd on bulk tank and DHIA SCC-score (each cow producing the same amount of milk/day)

	Bulk Tank Cell Count			DHIA SCC Score			
Cow No.	Cow SCC	Reduction in Bulk Tank SCC from culling each cow	Bulk Tank SCC	Cow DHIA SCC Score	Reduction in Herd DHIA SCC Score	Average Herd DHIA SCC Score	Converted Herd Cell Count
All cows	—	—	973,000	—	—	4.8	340,000
1	4,000,000	337,000	636,000	8.3	0.4	4.4	260,000
2	3,000,000	296,000	340,000	7.9	0.5	3.9	187,000
3	1,500,000	165,000	175,000	6.9	0.4	3.5	140,000
4	400,000	38,000	138,000	5.0	0.2	3.3	123,000
5	250,000			4.3			
6	200,000			4.0			
7	150,000			3.6			
8	100,000			3.0			
9	75,000			2.6			
10	50,000			2.0			

Cow 1 produces 41% of cells in the bulk tank milk.
Cows 1 and 2 produce 72% of cells.
Cows 1, 2, and 3 produce 87% of cells.

Table 8 illustrates the effect of culling a cow at different milk production and SCC levels on the bulk tank SCC of a herd of 50 cows averaging 50 lb milk/day.

Table 8. Culling one cow in 50 cow herd (Herd averaging 50 lb milk/day)

Cow to be culled (based on)					
DHIA SCC	DHIA SCC Score	Daily milk production of cow to be culled: (lb per day)			
		40	50	60	70
		(Reduction in bulk tank SCC)			
800,000	6.0	3,252	4,082	4,918	5,761
1,600,000	7.0	16,260	20,408	24,590	28,807
3,200,000	8.0	42,276	53,061	63,934	74,897
6,400,000	9.0	94,309	118,367	142,623	167,078

Table 9. Somatic cell counts as they relate to estimated milk losses

CMT (score)	WMT (mm)	Somatic cell count (cells/ml)	Milk loss (%)	Estimated milk Production loss per cow/year* (lb)
Negative	2	100,000	3	400
	5	200,000	6	800
Trace	8	300,000	7	1,000
	10	400,000	8	1,200
	12	500,000	9	1,300
1	14	600,000	10	1,400
	16	700,000		1,500
	18	800,000	11	1,600
	20	900,000		1,650
	22	1,000,000	12	1,700
2	25	>1,200,000	>12	>1,700

* Based on 14,000- to 15,000-lb average/cow/year

Source: Dairy Herd Improvement Association and Philpot (1984)

CMT interpretation:
negative: — Mixture remains liquid with no evidence of the formation of a precipitate.
Trace — A slight precipitate or small flakes form then disappear
1 (weak positive) — A distinct precipitate forms
2 (distinct positive) — The mixture thickens immediately with some gel formation

2. Understanding Contagious and Environmental Mastitis

Contagious Mastitis:

- ***caused by:***
  Streptococcus agalactiae (Strep. agalactiae)
  Staphylococcus aureus (Staph. aureus).
- ***primary source:***
  udders of infected cows.
- ***method of spread:***
  from infected quarters to other quarters and cows primarily at milking time.
- ***indicators of problem:***
  - *bulk tank somatic cell count (SCC) above 300,000 cells/ml.*
  - *DHIA SCC score above 3.2.*
  - *more than 15% of cows with a DHIA SCC score of 5 or greater.*
  - *frequent flare ups of clinical mastitis, often in the same cows.*
  - *bacterial culturing of cows shows Strep. agalactiae and/or Staph. aureus infections.*
- ***control recommendations:***
  - *develop program to prevent the spread of bacteria at milking time.*
  - *eliminate existing infections by treating all cows at drying off and culling chronic cows.*
- ***goals:***
  - *eradicate Strep. agalactiae from the herd.*
  - *reduce Staph. aureus infections to less than 5% of the cows in the herd.*

Environmental Mastitis:

- ***caused by:***

Coliforms	***Environmental streptococci***
Escherichia coli	*Strep. uberis*
Klebsiella pneumoniae	*Strep. bovis*
Klebsiella oxytoca	*Strep. dysgalactiae*
Enterobacter aerogenes	*Enterococcus faecium*
	Enterococcus faecalis

- ***primary source:***
  the environment of the cow.
- ***indicator of problem:***
  high rate of clinical mastitis, usually in early lactation or during hot weather. Somatic cell count may be low (less than 300,000).
- ***control recommendations:***
  - *reduce the number of bacteria to which the teat end is exposed.*
  - *improve cleanliness of cows' surroundings, especially in late dry period and at calving.*
    [see section 5 on controlling environmental mastitis]
  - *improve prepping procedures to ensure clean, dry teats are being milked.*
    [see section 8 on proper milking procedures]
- ***goal:***
  reduce clinical mastitis to less than 3% of the milking cows/month.

3. Controlling Contagious Mastitis

Staphylococcus aureus infections remain the largest mastitis problem on Kentucky dairy farms. Cure rate with antibiotic therapy during lactation is very low. Many "staph" cows become chronic and have to be culled.

Streptococcus agalactiae is the other contagious bacteria. This bacteria responds well to antibiotic therapy and can be eradicated from dairy herds with good mastitis control practices.

Control

1. Prevention:

- **Improved milking procedures.**
  - milk clean, dry teats.
  - keep liner slips to a minimum.
  - teat dip with an effective germicidal teat dip.
  - maintain milking system.

2. Eliminating infections

- Treat all quarters of all cows at drying off with antibiotic products specifically designed for dry cow therapy.
- Cull chronically infected cows.

Steps to Follow

To control mastitis and lower somatic cell count:

1. Teat dip.
2. Dry cow treat.
3. Practice proper milking procedure.
4. Use properly functioning milking system.
5. Maintain clean, dry environment for the cows.
6. Cull chronic mastitis cows.
7. Use DHIA SCC program to monitor mastitis in the herd.

4. Characteristics of Environmental Mastitis

Primary source of environmental bacteria:

- the surroundings or environment of the cow (manure, bedding, soil, contaminated water, etc.).

Risk of environmental mastitis infections:

- higher during the dry period than during lactation.
  - high during the first two weeks of the dry period.
  - increases during the last two weeks of the dry period, and is markedly elevated around calving time.
- during lactation the risk is highest during early lactation and decreases as lactation advances.
- increases as the concentration of cows increases.
- housed cows are generally at greater risk than cows on pasture.
- increases during hot summer months.

Rate of clinical mastitis from environmental bacteria:

- average 36 cases/year or 3 cases/month in a 100 cow herd (3% of the herd per month).
- low rate -- 1% per month.
- high rate -- 8% per month.

Cost of clinical mastitis

Herds with low SSC (and therefore very little milk production loss from subclinical mastitis) can experience considerable loss from clinical mastitis caused by environmental bacteria. A recent nine herd study estimated the cost of each case of clinical mastitis (Table 10). The average cost was $107 but ranged from $46 for the low herd to $142 for the highest herd.

Table 10. Cost of clinical mastitis

Item	Cost per cow	% of total cost
Decreased milk production	$55	51
Discarded milk	35	33
Medication	12	11
Veterinary	2	2
Labor	3	3
TOTAL	$107	100%

Source: Hoblet et al., *1991 Proceedings of the National Mastitis Council.*

Somatic cell counts:
- *may be low (bulk tank count <300,000 and 85% or more of the cows in the herd with a DHIA SCC score of 4 or less), indicating good control of contagious mastitis.*
- *these herds may still have a problem with clinical mastitis caused by environmental bacteria.*

Duration of infections by environmental bacteria:
- *relatively short.*
- *coliform infections tend to be very short:*
  - *more than 50% last less than 10 days.*
  - *nearly 70% last less than 30 days.*
  - *coliform infections can become chronic.*
  - *however, only 1.5% of E. coli infections persist more than 100 days.*
- *environmental streptococci infections:*
  - *last longer than coliforms, but shorter than Strep. agalactiae.*
  - *60% have a duration of less than 30 days.*
  - *approximately 18% become chronic and are present for more than 100 days.*

Clinical symptoms — environmental infections:
- *clinical cases of environmental mastitis are generally associated with clotty or flaky milk.*
- *clinical symptoms of environmental mastitis are not distinguishable from those caused by contagious (Staph. aureus and Strep. agalactiae) mastitis infections.*

Clinical symptoms — coliform infections:
- *80 to 90% of coliform infections present during lactation will result in clinical mastitis.*
- *only 8 to 10% of coliform infections result in acute mastitis.*

Clinical symptoms — environmental streptococci:
- *approximately 50% of environmental streptococci infections present in lactation will cause clinical mastitis.*

Prevalence of environmental infections:
- *the percent of quarters infected with environmental bacteria at any point in time in a dairy herd is generally low. Generally less than 10% of quarters are infected with environmental pathogens.*
- *however, environmental pathogens can be responsible for a high percent of the clinical mastitis cases in a herd because of the short duration of the environmental infections.*

Herd monitoring methods:
- *a high rate of clinical mastitis in the first two to three months of lactation indicates an environmental problem.*
- *keep accurate records of the incidence of clinical mastitis.*
- *culture milk from clinical quarters.*
- *analyze records.*

Treatment — coliform mastitis:
- *antibiotics approved for use in lactating dairy cows are uniformly ineffective against coliform bacteria.*

Treatment — environmental Streptococci mastitis:
- *therapy during lactation will generally cure about 50 to 60% of the cases.*
- *dry cow therapy eliminates the majority of infections present at drying off and significantly reduces the rate of new infections during the first two weeks of the dry period.*

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5. Controlling Environmental Mastitis

Prevention is the key:
- *reduce the number of bacteria to which the teat end is exposed.*

Environment:
- *cow's environment should be as clean and dry as possible.*
- *cow should not have access to manure, mud, or pools of stagnant water.*
- *the environment of the dry cow is as important as that of the lactating cow.*
- *a clean calving area is a must.*
- *free stalls should be designed and maintained properly.*

Bedding:
- *numbers of bacteria in bedding will depend on available nutrients, amount of contamination, moisture, and temperature.*
- *inorganic materials such as sand or crushed limestone will be low in nutrients and moisture and therefore, bacteria.*

- *finely chopped organic bedding materials such as sawdust, shavings, recycled manure, pelleted corncobs, peanut hulls and chopped straw frequently are high in bacteria numbers.*

TEAT DIPPING:
- *post milking teat dipping with a germicidal dip (germ-killing) is recommended.*
- *it will control the spread of contagious mastitis.*
- *exerts some control over environmental streptococci*
- *exerts no control over coliform infections.*
- *barrier dips are reported to reduce new coliform infections; however, they do not appear to be as effective against environmental streptococci and the contagious pathogens.*
- *attempts to control environmental mastitis during the dry period, using either germicidal or barrier dips, have been unsuccessful.*

DRY COW THERAPY:
- *recommended for all quarters of all cows at drying off.*
- *helps control environmental streptococci during the early dry period.*
- *has little or no value in controlling coliforms.*
- *not effective during the period prior to calving.*

BACKFLUSHING MILKER CLAWS BETWEEN COWS:
- *will not control environmental mastitis.*

PROPER MILKING PROCEDURE:
- *Proper milking procedure is important.*
- *Teats, but not the udder, should be washed.*
- *Teats should be clean and dry before the milking machine is attached.*
- *Milking wet udders will likely increase mastitis. [see section 8 on proper milking procedures from the National Mastitis Council]*

PREDIPPING:
- *using a germicidal teat dip reduces environmental mastitis during lactation by 50%.*
- *use extreme caution to be sure that the teat dip is removed from the teats before the milking machine is attached to prevent contamination of the milk.*

MILKING MACHINE:
- *should be maintained and operated properly.*
- *badly functioning milking machines resulting in frequent liner slips and teat end impacts will increase environmental mastitis.*

NUTRITION:
- *proper nutrition will reduce the risk of environmental mastitis.*
- *adequate levels of vitamin E and selenium will reduce the incidence of environmental mastitis.*
- *there are conflicting reports whether vitamin A and b-carotene influence udder health.*
- *ongoing research at the University of Kentucky indicates that copper may also play a role in maintaining the immune system in dairy cattle.*
- *care should be taken to feed dairy cattle a balanced ration.*

VACCINES:
- *Against coliform bacteria:*

E. coli J5 vaccines are core antigen vaccines that will reduce the number and severity of clinical cases due to coliform bacteria including Escherichia coli, Klebsiella, Enterobacter and Serratia. Vaccination of cows with E. coli J5 vaccine at drying off, 30 days before calving and at calving resulted in a 70% to 80% reduction in clinical coliform cases of mastitis.

A core vaccine utilizing Salmonella typhimurium R/17 bacteria has positive but limited research results.
- *Against Staphylococcus aureus bacteria:*

Development of vaccines against Staphylococcus aureus bacteria is an area of active research with some promising developments. However, current control of Staph. aureus mastitis must be achieved through proper milking hygiene (especially post milking teat dipping), dry cow therapy and culling of chronic cows.

6. Mastitis Detection and Troubleshooting Herd Problems

Records are an extremely important detective tool. The more accurate records that are available on individual cows and the herd, the more precise the diagnosis of the mastitis problem.

Is the mastitis problem caused primarily by contagious or environmental mastitis pathogens? Table 11 will help to determine the cause of the problem and the control procedures needed.

Table 11. Mastitis detection

Indicators	Contagious mastitis	Environmental mastitis
Bulk tank somatic cell count (SCC) (cells per ml)	Usually over 300,000	Consistently under 300,000
Monthly herd avg. DHIA SCC	Usually over 300,000	Consistently under 300,000
Monthly herd avg. DHIA SCC score	Over 4.0	Under 3.5
% cows in herd with DHIA SCC score of 4 or less or DHIA SCC of 282,000 or less	Less than 85%	Over 85%
% cows in herd with CMT or paddle test negative or trace	Less than 85%	Over 85%
% cases of clinical mastitis in herd per month	Variable	Over 3% (over 3 cases per 100 cows)
NOTE: Detection of clinical mastitis is extremely variable. Special effort should be made at each milking to detect clinical cases.		
When do clinical cases occur	Throughout lactation	Primarily at calving & early lactation
Microbiological culturing of milk samples.		
Sample method:	Composite samples from entire herd or 10-20% of cows if a large herd	Clinical quarters when they flair up but before treatment. Representative no. of cows 3 to 10 days after calving.
Mastitis pathogens	Staph. aureus Strep. agalactiae	E. coli Klebsiella Strep. uberis

7. Using DHIA Somatic Cell Count in Mastitis Detection and Troubleshooting Herd Problems

DHIA Herd Summary (DHI-202)

A (Table 12). Somatic Cell Count Summary *(bottom right corner of DHI-202)*

Average actual SCC

- ***Trend:*** *declining*
- ***Goal:*** *less than 200,000*

% cows SCC score of 4 or less (283,000 actual)

- ***Goal:*** *85%*

B (Table 13). Stage of lactation profile *(upper left corner of page on DHI-202)*

- ***Goal:***
  - *1st lactation animals below 3.0*
  - *2nd and later lactation animals below 4.0*

If SCC score increases as cows and heifers go through lactation, this indicates animals are becoming infected with mastitis pathogens.

SCC score greater than 3.9 or actual SCC greater than 200,000 indicates possible infections.

Possible causes of this increase in mastitis are:

- *failure to teat dip consistently.*
- *failure to get proper coverage of teat dip on teats.*
- *ineffective germicide in teat dip.*
- *allowing too many liner slips.*
- *improper cow preparation.*
  - *not cleaning teats*
  - *not drying teats*
  - *not using individual towels*
- *malfunctioning milking equipment.*
- *dirty environment.*

If the SCC score is high in early lactation, possible causes include:

- *unsanitary calving area*
- *dirty dry cow environment*
- *improper dry cow therapy (2nd lactation & older)*

C (Table 14). Current Somatic Cell Count Summary (right side of DHI-202)

Pay special attention to first lactation animals. They are the future of the herd

- ***Goal:***
  - *90% of first lactation cows with SCC score of 4 or less*
  - *no more than 8% of the entire herd should have a SCC score of 6 or greater*

Table 12. Somatic cell count summary

	SOMATIC CELL COUNT SUMMARY						
	% COWS SCC SCORE						
DATE	0,1,2,3	4	5	6	7,8, 9		
OF TEST	BELOW 142,000	142,000-283,000	284,000-565,000	566,000-1.13M	OVER 1.13M	SCC SCR	ACT
MONTH DROPPED	60	23	10	4	3	3.3	235
8-14-95	79	13	3	5		2.6	151
9-17-95	72	17	7	3	1	2.5	163
10-13-95	79	13	2	3	3	2.3	120
11-12-95	75	10	9	3	3	2.4	140
12-10-95	85	10	3	2		2.1	98
1-12-96	83	9	3	3	2	2.2	113
2-11-96	82	10	3	5		2.2	101
3-19-96	73	15	9	2	1	2.4	132
4-13-96	78	12	7	3		2.1	96
5-19-96	70	20	10			2.4	115
6-14-96	82	15	2	1		2.1	104
7-17-96	76	11	8	1	4	2.5	141
AVERAGES	78	12	6	3	1	2.3	121

Table 13. Stage of lactation profile

		STAGE OF LACTATION (DAYS)					
		1 THRU 40	41 THRU 100	101 THRU 199	200 THRU 305	306+	TOTAL OR AVERAGE
NUMBER MILKING	1ST LACT	2	4	4	6	5	21
	2ND LACT	2	5	3	10	1	21
	3+ LACTS	6	5	10	19	2	42
	ALL LACTS	10	14	17	35	8	84
SCC SCR	1ST LACT	2.8	2.3	1.6	1.7	4.5	2.1
	2ND LACT	2.6	2.1	2.4	2.2	3.6	2.4
	3+ LACTS	3.0	2.3	1.8	2.3	4.1	2.2
	ALL LACTS	2.8	2.2	1.9	2.0	4.0	2.3
SCCS	NUMBER	3	3		2	3	11
> 4.0	PERCENT	30	21	0	6	38	11

D (Table 15). Somatic Cell Count Profile (DHI-520) (an optional report)

- *cows are listed from highest to lowest in SCC.*
- *percent contribution of each cow to the bulk tank SCC is given.*
- *expected bulk tank SCC as high SCC cows are removed is given.*
- *SCC score or actual SCC of each cow is given.*
- *number of times each cow has tested over 3.9 SCC score or 200,000 actual SCC is given.*
- *new (new), previous (PRV) and chronic (CHR) infections are flagged in the Mastitis Infect column.*
- *this SCC profile report also includes five graphs showing overall SCC trends and comparisions with top herds.*

E. Stage of Lactation Profile for Somatic Cell Count (DHI-521)

- *The lactation profile for somatic cell count has some of the same information that is found in the Stage of Lactation Profile. In addition it gives the percentage of cows above 200,000 somatic cell count or a 3.9 SCC Score. This is used to estimate the number of new and chronic mastitis infections. A new infection is an animal with a SCC over 200,000 for the first time this lactation. A chronic infection is an animal with a SCC count over 200,000 this test plus two or more consecutive tests over the 200,000 this lactation.*

Table 14. Current month SCC

		CURRENT SOMATIC CELL COUNT SUMMARY				
		HERD PRODUCTION LOST FROM SCC THIS TEST PERIOD		MILK = 3,883 $ = 584		
	NUMBER OF COWS	% COWS SCC SCORE 0,1,2,3 BELOW 142,000	4 142,000-283,000	5 284,000-565,000	6 566,000-1,130,000	7,8,9 OVER 1,130,000
1ST LACT	34	72	6	11		11
2ND LACT	30	86	10	3		1
3+ LACTS	58	77	16	4	2	1
ALL LACTS	122	76	11	8	1	4

Table 15. Somatic cell count profile (DHI-520)

BARN NAME OR COW INDEX	TEST DAY MILK PREVIOUS	TEST DAY MILK CURRENT	SOMATIC CELL COUNT TEST DATE 03-12	TEST DATE 04-15	TEST DATE 05-14	TEST DATE 06-19	TEST DATE 07-12	THIS TEST	MASTITIS INFECT. *	% BULK TANK SCC	AV. SCC W/O THIS COW & COWS ABOVE THIS COW	LACT. AVG. SCC SCORE	#SCC TESTS THIS LACT.	# TESTS OVER 3.9 SCC SCORE	DAYS IN MILK	DUE DATE	LACT. NO.	RATING
BESS	64	47	123	18	24	36	18	5572	NEW	13	435	1.7	9	1	266		1	B
THELMA		63	85	230	452	DRY	DRY	2425	NEW	8	395	8.1	1	1	19		1	
JOANN	83	82	DRY	DRY	10	24	13	1715	NEW	7	360	2.1	4	1	104		4	D
JANE	71	58	450	345	275	315	325	2111	CHR	6	330	5.0	9	7	246	12-11-96	2	C
GRETA	60	37	675	630	620	565	303	2263	CHR	4	310	6.1	13	13	395	02-17-97	6	D
STAR	49	46	800	750	953	1215	1393	1838	CHR	4	290	7.0	9	9	257	12-09-96	3	E
CONNIE	102	81	600	650	895	775	606	1131	CHR	4	270	5.7	6	6	161		4	C
TINA	82	83	542	732	960	580	746	985	CHR	4	250	3.3	9	5	246	11-15-96	1	A
ARLO	107	120	85	DRY	DRY	75	200	696	CHR	4	230	4.5	3	2	87		7	B
VALLEY	100	95	300	430	DRY	DRY	187	650	NEW	3	215	4.8	2	1	50		2	C
GEM		74	453	150	362	DRY	DRY	800	NEW	3	200	6.0	1	1	12		2	
ADEEN	96	125	42	65	DRY	DRY	303	528	CHR	3	185	5.0	2	2	37		4	
LESLIE	72	58			362	258	141	857	CHR	2	175	5.3	8	6	215			A
KITTY	72	58	65	100	98	85	41	606	NEW	1	170	1.8	7	1	189	2-23-97	3	D
ANNE	75	77	800	832	945	1190	373	400	CHR	1	165	5.3	9	9	262		4	D

* NEW * Animals with SCC Score > 4 (200,000) for the first time this lactation.

* CHRONIC * SCC Score > 4 (200,000) this test, and 2+ consecutive test dates this lactation.

* PRV * SCC Score > 4 (200,000) 2+ consecutive test dates this lactation.

F. Use of Individual Cow DHIA-SCC Scores

- *cull chronic cows (SCC score 5 month after month).*
- *milk high SCC score cows last.*
  - *milk with separate claw.*
- *monitor effectiveness of treatment.*
  - *do not treat cows during lactation based **only** on SCC.*
- *early drying off of problem cows.*
  - *this practice will lower the bulk tank SCC.*
  - *treat all cows with dry cow therapy product at drying off.*
- *problem herds can withhold milk from high SCC cows.*
- ***don't buy mastitis!***
  - *check DHIA-SCC records.*
  - *have veterinarian culture cow's milk.*
  - *run CMT or paddle test on the cow's milk.*

8. PROPER MILKING PROCEDURE

- *Proper milking procedure is important.*
- *Milking wet udders will likely increase mastitis.*
- *Teats, but not the udder, should be washed.*
- *Teats should be clean and dry before the milking machine is attached.*

THE NATIONAL MASTITIS COUNCIL RECOMMENDED MILKING PROCEDURES (NMC BULLETIN):

1. *Provide a clean, stress-free environment for cows.*
2. *Check foremilk and udder for mastitis.*
3. *Wash teats with an udder wash sanitizing solution.*
4. *Dry teats completely with individual paper towel.*
5. *Attach milking unit within one minute after the start of stimulation.*
6. *Adjust units as necessary for proper alignment.*
7. *Shut off vacuum before removing unit.*
8. *Dip teats immediately after unit removal with an effective product.*

PREDIPPING:

- *using a germicidal teat dip reduces environmental mastitis during lactation by 50% in some herds.*
- *extreme caution should be taken to be sure that the teat dip is removed from the teats before the milking machine is attached to prevent contamination of the milk.*
- *use only a teat dip which is listed with the FDA and has predipping instructions on the label.*
- *apply properly:*
  - *pre-clean teats as necessary; teat should be free of manure and visible dirt.*
  - *forestrip*
  - *apply teat dip*
  - *allow 30 seconds contact time*
  - *dry teats with single-service paper towels*
  - *attach milking unit within one minute after the start of stimulation*

Milk teats that are clean, dry, and free of residue.

TEAT DIP PRODUCTS:

- *Producers should use only teat dip products that are:*
  1. *listed with the Food and Drug Administration (FDA)*
  2. *of proven effectiveness*

Those that have been shown to be effective under field conditions include chlorhexidine (0.5 percent), iodophor (0.5 to 1.0 percent available iodine), hypochlorite (4 percent), chlorous acid-chlorine dioxide, linear dodecyl benzene sulfonic acid (1.94%) and ambicin N™.

- *If the teat dip complies with FDA rules, the label will state clearly the name and percentage concentration of each active ingredient, directions for use, name and address of manufacturer or distributor, production lot number, and an expiration date.*

- ***FDA does not require proof of effectiveness for labeling.** Information from the manufacturer should be requested on compliance with FDA regulations and effectiveness.*

- *The National Mastitis Council recently recommended protocols for determining efficacy of experimental postmilking teat dips in preventing infections. The three protocols are designed to:*
  1. *determine efficacy of a teat dip in preventing new infections following experimental exposure of teats to mastitis bacteria.*
  2. *determine efficacy of a teat dip in preventing naturally-occurring mastitis infections.*
  3. *compare the efficacy of an experimental teat dip with that of a teat dip efficacious in reducing naturally-occurring mastitis infections.*

9. Milking Machine Inspection and Maintenance Checklist

Before each milking check:

_ *vacuum controller*
_ *milking vacuum*
_ *hoses and teatcup liners for holes or tears*
_ *pulsators*
_ *air admission holes in claw or tailpiece of liner.*

Weekly (or every 50 hours of operation) check:

(Set aside one day each week to perform these checks, such as every Monday morning.)

_ *and clean vacuum controller*
_ *and clean pulsator filters*
_ *belts on vacuum pump(s)*
_ *the oil reserve on the vacuum pump*
_ *if it is time to change the liners (every 1000-1200 milkings or as recommended)*
_ *and clean moisture trap*
_ *automatic take off equipment (especially vacuum shut off).*

Monthly (or every 250 hours) check:

(Set aside one day each month to perform these checks, such as the first Monday of each month).

_ *and clean the pulsators*
_ *and clean vacuum pulsation lines*
_ *vacuum pump(s)*
  _ *check belts for wear and tension*
  _ *clean screens*
  _ *change filters on vacuum pump tank*
  _ *change oil if needed*
_ *change liners if it is time.*

Dealer Checks and Service:

Every 6 months or 1,250 hours:

Checks to be made	***Equipment needed***
_ *Air delivery by vacuum pump*	*Air flow meter*
_ *Reserve air flow (remaining pump capacity with units operating but not on cows)*	*Air flow meter*
_ *Pulsator rate (pulsations per minute)*	*Watch*
_ *Pulsator function and ratio*	*Vacuum recorder*
_ *Vacuum level*	*Vacuum Gauge*
_ *Line voltage*	*Voltmeter*

Maintenance Items:

_ *check all gaskets, flappers, "O" rings, and caps which come in contact with milk. Replace if worn.*
_ *clean all electric pulsator selectors and activators. Check all solenoids and coils. Clean all plungers and vacuum lines.*
_ *overhaul pneumatic pulsators. Repair milker supports, milker units, etc.*

Every year or 2,500 hours of use:

_ *change all solenoid coils, plungers, hoses, diaphragms, caps, gaskets, flappers, and rubber vacuum connectors.*
_ *check electric timer controls, switches, motors, and parts. Grease all bearings.*
_ *check milk pump seal, rubber spring, and clearances. Change gaskets.*

Every 2 years or 5,000 hours of use:

_ *recondition entire system including all motors, pumps, selectors, timers, and starters.*
_ *replace all rubber coils, hoses, gaskets, "O" rings, springs, and plungers. Clean entire pipeline system.*

For more information on milking machines, refer to: *"The Modern Way to Effective Mllking," published by the Milking Machine Manufacturers Council of the Farm and Industrial Equipment Institute, 410 N. Michigan Ave., Chicago, IL 60611-4251.*

10. Proper Treatment Procedures

Lactation or Dry Cow Therapy

Extreme care must be taken whenever anything is being infused into a cow's udder. Careless treatment procedures can result in udder infections resistant to treatment.

Approach treatment in the same way a surgeon approaches surgery.

1. *Wash hands with soap and water.*
2. *Wash teats and udder in sanitizing solution.*
3. ***Thoroughly** dry teats and udder with individual towels.*
4. *Dip teats in an effective germicidal teat dip.*
5. *Allow 30 seconds of contact time before wiping off teat dip with an individual towel.*
6. *Thoroughly scrub the teat end with a cotton swab soaked in alcohol. If all four quarters are being treated, start by cleaning the teat farthest from you and work toward the closest teat.*
7. *Use commercial antibiotic products in single dose containers formulated for intramammary infusion. For dry cow therapy, use commercial antibiotic products specifically formulated for dry cow therapy in single dose containers. Treat teats nearest to you first, then those farthest away to prevent contaminating clean teat ends.*
8. *Insert only the tip of the canula into the teat end. Do not allow the sterile canula to touch anything prior to infusion.*
9. *After infusion, remove canula, squeeze teat end with one hand, massage antibiotic up into the quarter with the other hand.*
10. *Dip teats in an effective germicidal teat dip after treatment.*

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11. How to Collect Milk Samples for Identification of Bacteria-Causing Mastitis

1. *Label sterile tubes and fill out forms ahead of time. (Tubes with screw caps are preferred.)*
2. *Wash hands with soap and water.*
3. *Wash teats in sanitizing solution.*
4. *Dry teats with individual towels.*
5. *Discard one or two squirts of milk from each teat.*
6. *Dip teats in a germicidal teat dip.*
7. *Allow 30 seconds of contact time before wiping off teat dip with an individual towel.*
8. *Thoroughly scrub the teat end with a cotton swab soaked in alcohol. If a composite sample is being taken from all four quarters, start with the teat farthest from you and work toward the closest teat. Use a clean swab on each teat.*
9. *Open the sterile tube under the teats. Hold it at an angle so that material cannot fall into the opening. Do not allow anything to come in contact with the mouth of the tube. Collect one or two squirts of milk from each quarter, starting with the closest quarters and working toward the ones farthest away.*
10. *Close the container before removing it from beneath the teats.*
11. *Refrigerate samples until they reach the lab. If samples will not reach the lab within 24 hours, they should be frozen and kept frozen until they reach the lab.*

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