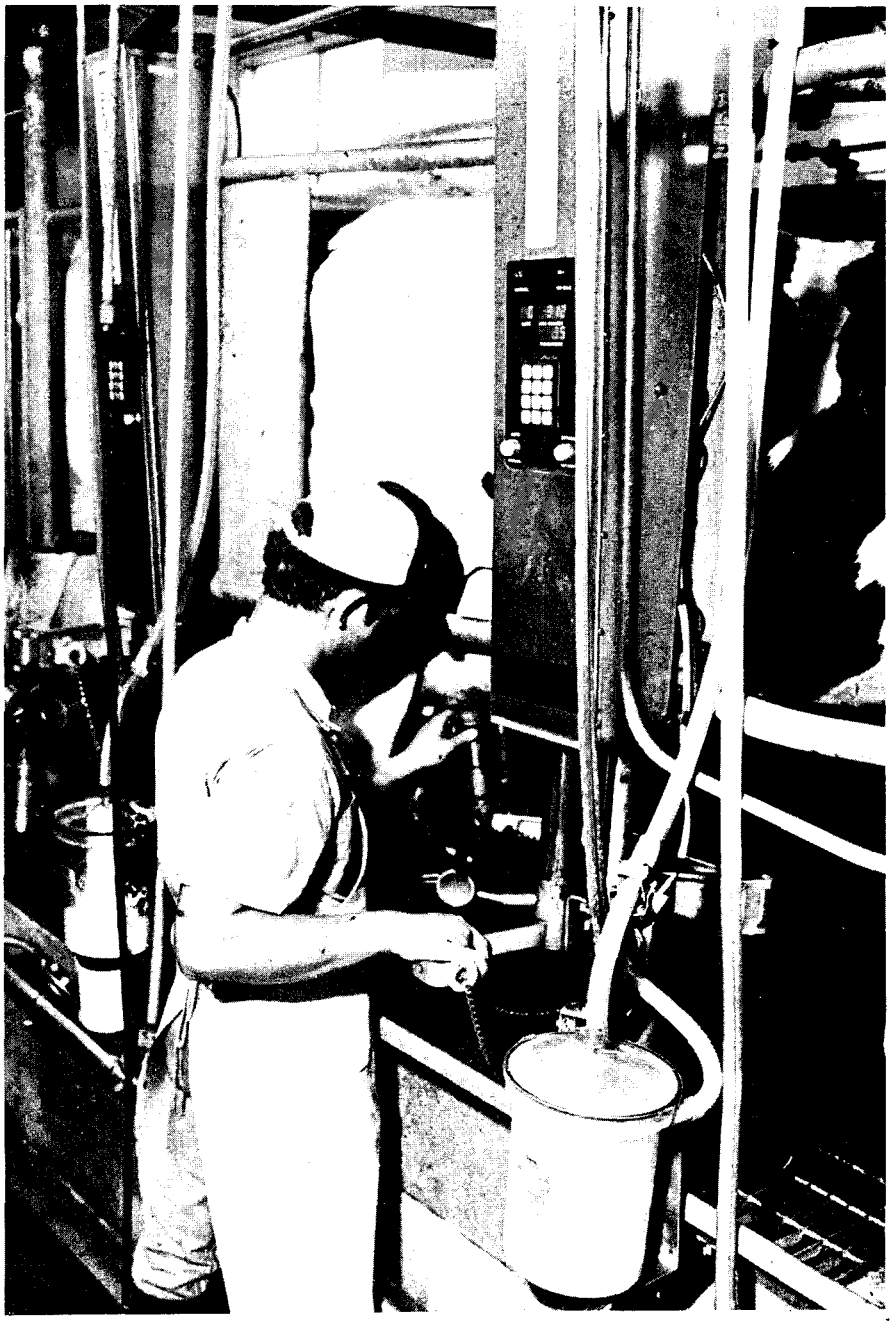
Somatic Cell Count

An Effective Tool in Controlling Mastitis



Developed in cooperation with and financed in part by the Minnesota State Dairy Herd Improvement Association.

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Mastitis is the most costly disease on the dairy farm today. Nearly 70 percent of this loss is a result of reduced milk production caused by subclinical mastitis.

Mastitis is largely a management disease. To be successful in controlling it, you must be willing to admit that the cause of mastitis probably is due to your own managerial shortcomings.

The Minnesota Dairy Herd Improvement-Somatic Cell Count (DHI—SCC) program is a management tool designed for use as an integral part of a mastitis control program. Successful use of this tool depends on your knowledge and understanding of the SCC report. Proper use of this report not only will create an awareness of the level of mastitis in your herd, but also will give you some idea of what the most likely causes of your mastitis problems are. The Minnesota DHI-SCC program is a herd mastitis prevention program, not an individual cow treatment program. The emphasis is on prevention, not treatment.

Herds Not on the SCC Program

If you do not have your herd on the DHI-SCC program, you can get an idea of your situation by comparing your bulk tank Wisconsin Mastitis Test (WMT) score to the standards shown in table 1. Bulk tank WMT scores less than 6 or bulk tank cell counts less than 200,000 indicate there is no serious mastitis problem. If your scores are within these ranges, your challenge will be to maintain a clean herd. For you, the SCC program will be a monitoring tool that will enable you to respond to potential problems before they become a major concern. Bulk tank WMT scores greater than 8 or bulk tank cell counts greater than 300,000 indicate significant subclinical mastitis. If your scores are within these ranges, the SCC program will be an aid in improving mastitis control.

Table 1. Comparison of bulk tank WMT scores with somatic cell counts.

WMT	SCC	Subclinical mastitis assessment of herd
6 or below	Below 225,000	**Excellent:** Maintain control measures.
8-12	300,000-465,000	**Fair:** Check for chronic cows and introduce control measures.
14-16	565,000-675,000	**Unsatisfactory:** Subclinical mastitis may be widespread in your herd.
18-20	790,000-920,000	**Poor:** High level of infection present in herd. Large dollar loss due to mastitis.
22 or above	1 million or above	**Very poor:** Immediate action called for. Obtain individual cow results. Cull or dry off problem cows. DO NOT WAIT. DO IT TODAY.

The authors are extension dairy specialists.

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Interpretation of Individual Cell Counts

Before we discuss the interpretation of individual somatic cell counts, let us review some basics. The term somatic cell is a general term referring to the white blood cell. White blood cells are extremely important in combating mastitis. If the udder becomes infected or injured, large numbers of white blood cells migrate to the mammary gland to destroy and remove either the bacteria or the toxin they produce. Therefore, high somatic cell counts in the milk are a strong indication of the presence of an infection.

Although the question of what represents a "normal" cell count remains unanswered, there clearly is a linear relationship between cell count and milk yield (see figure 1).

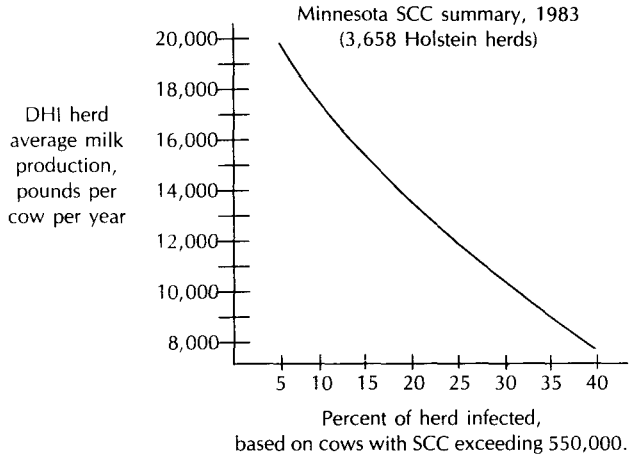

Figure 1. Average milk production of herds at various levels of infection.

Linear Somatic Cell Count

The linear somatic cell count provides a more meaningful method of evaluating mastitis in your herd. Linear somatic cell counts (SCC) help you:
(1) measure effects of subclinical mastitis on your herd;
(2) identify cows affected by subclinical mastitis;
(3) measure reduction in subclinical mastitis as improvements in management are made; and
(4) identify temporary or long-term problems that might otherwise be undetected.

SCC Scores: Somatic cell count scores have been converted to a "linear score" from 0 to 9. Each increase of 1 in score is associated with a doubling of cell counts (see table 2).

The linear score has a straightforward relationship to loss of milk yield (table 3). When you analyze your entire herd, it emphasizes the economic losses occurring in your herd because of subclinical mastitis.

The infiltration of white blood cells through the milk secretion tissue, whether caused by infection or other tissue irritation, results in lowered milk yield by that mammary tissue. Each time the cell count doubles, the expected decrease in milk production for older cows is approximately 1.3 pounds per day or 400 pounds per lactation. Corresponding figures for first lactation cows are .6 pounds per day or 200 pounds per lactation. Producers should, therefore, attempt to lower individual cow and herd cell counts as much as is practical to take advantage of more efficient production. Current evidence suggests that an average herd SCC of 150,000 or less is a reasonable and desirable goal.

Approximately 95 percent of cows with counts of less than 100,000 (linear score of 2 or less) would be considered free of mastitis. Any cow with a single cell count of 300,000 or more (linear score of 5 or more) can be considered infected. Cows with a linear score of 3 or 4 should be considered "suspect." According to research available, about 25 percent of these cows have mastitis. As cell counts increase, production losses are generally more severe (table 3).

Heifers generally have lower counts than older cows. A reasonable explanation would be that since older cows have been in the herd longer and have been milked more times, they are more likely to have been subjected to management-induced mastitis. An ideal goal would be that 90 percent or more of the cows in a herd have counts less than 250,000 cells. A reasonable goal would be to have 10 percent or less of the cows positively infected with subclinical mastitis.

Table 2. Relationship of Linear SCC Scores to Regular Somatic Cell Counts and California Mastitis Test.

Linear SCC	Somatic Cell Count Mid-Point	Somatic Cell Count Range	California Mastitis Test
0	12,500	0 to 17,000	Negative
1	25,000	18,000 to 34,000	
2	50,000	35,000 to 70,000	
3	100,000	71,000 to 140,000	
4	200,000	141,000 to 282,000	Trace
5	400,000	283,000 to 565,000	1
6	800,000	566,000 to 1,130,000	
7	1,600,000	1,131,000 to 2,262,000	2
8	3,200,000	2,263,000 to 4,525,000	3
9	6,400,000	4,525,000 and up	

Table 3. Linear SCC Scores and Relationship to Daily and Lactation Milk Yield Losses.

Linear SCC	Daily Yield Lost: First Lactation	Daily Yield Lost: Older Cows	Lactation Yield Lost: First Lactation	Lactation Yield Lost: Older Cows
	(....lbs./day....)		(...lbs./lactation...)	
0-2	0	0	0	0
3	0.6	1.3	200	400
4	1.3	2.6	400	800
5	2.0	3.9	600	1200
6	2.6	5.2	800	1600
7	3.3	6.6	1000	2000
8	3.9	7.9	1200	2400
9	4.6	9.2	....	....

Interpreting Herd Summaries

The Minnesota DHI-SCC report has several herd summaries, namely: Current SCC Summary (figure 2); Herd Average SCC (figure 3); SCC Trends (figure 4) and yearly SCC Summary (figure 6).

Current SCC Summary (figure 2) evaluates first lactation cows separately from older (other) cows. Since older cows have been in the herd longer and have been milked more times, they are more likely to have been subjected to management-induced mastitis.

When appropriate mastitis control procedures are used, 90 percent or more of the first lactation cows should be in columns 0, 1, 2 or 3, with most of the remaining cows in column 4.

Any time several cows in either age bracket are in columns 5, 6, 7, 8 and 9, it suggests a need for you to review your mastitis control program. Special attention should be given when there is a marked shift, with more animals in a higher numbered column from one sample day to another.

CURRENT SCC SUMMARY											
LACT NO	NUMBER COWS	NUMBER OF COWS ON SAMPLE DAY									
		0	1	2	3	4	5	6	7	8	9
1ST	3				3						
OTHER	24	6			8	3	3	3	1		
ALL	27	6			11	3	3	3	1		

Figure 2. Number of cows, by age group, for each linear SCC score.

In figure 3, Herd Avg SCC, the number in the "Cells" section represents the weighted herd average somatic cell count. It is calculated by multiplying each cow's sample day milk yield times the number of somatic cells in her milk, summing over the entire herd, dividing by total milk yield. Variation between Herd Avg SCC and bulk tank count results can be expected. This variability is due to: (a) variability in sensitivities of the different test methods used, (b) sample day differences, and (c) some milk from specific cows being withheld from the bulk tank.

HERD AVG SCC
CELLS 204,000
LINEAR 3.1

ESTIMATED DAILY MILK YIELD LOST = 54 LBS

Figure 3. Herd average SCC.

Estimated Daily Milk Yield Lost in figure 3 (a computer printed statement on the line just below the "herd average SCC") represents the estimated total herd loss in daily production. It is calculated from each cow's current sample day linear SCC score and the data presented in table 3. If this loss (i.e., 54 lbs.) is representative of each month, the milk is priced at an average value (i.e., $12 per cwt.), the estimated annual loss in milk production on this farm is $2,365 (54 lbs × 12¢ × 365 days).

SCC TRENDS			
LACT NO	PCT POSITIVE OR V STRONG		
	CURRENT	LAST MO	YEAR AGO
1ST	0	0	0
OTHER	9	13	18
ALL	6	10	14

Figure 4. Sample somatic cell count trend summary.

SCC Trends

The trend summary categorizes the infection status of heifers and older cows, comparing the percentage of infected heifers and older cows from a current sample with samples from last month and a year ago. This herd summary is useful for monitoring progress in mastitis control over both the short and long term.

The heifers in the trend summary shown in figure 4 have remained clear of mastitis, indicating that control procedures preventing cow-to-cow spread of mastitis are working well. Progress also may have been made by successful dry cow therapy or the culling of chronically infected old cows.

Drastic increases in the percentage of infected cows from one month to the next (see figure 5) should raise questions and initiate an investigation into what is happening:

1. Is there an equipment problem such as a loose belt on the vacuum pump, a stuck vacuum regulator, a plugged vacuum line, or any other equipment defect that might have a detrimental effect on the milking characteristics of a machine?
2. Is a different person doing the milking?
3. Has there been a sudden and severe change in the weather, with lots becoming muddy and cows becoming wet and dirty and developing frozen teats or other teat problems?
4. Has there been a sudden onset of a disease process such as pseudo cowpox or ulcerative mammillitis that might be causing teat end damage?

SCC TRENDS			
LACT NO	PCT POSITIVE OR V STRONG		
	CURRENT	LAST MO	YEAR AGO
1ST	15	7	3
OTHER	21	7	9
ALL	20	7	7

Drastic increase

SCC TRENDS			
LACT NO	PCT POSITIVE OR V STRONG		
	CURRENT	LAST MO	YEAR AGO
1ST	29	0	5
OTHER	50	17	15
ALL	45	12	12

Figure 5. Examples of drastic increases in percentage of infected cows.

YEARLY SCC SUMMARY				
LACT NO	PCT POSITIVE OR V STRONG			
	<30 DIM	30-220 DIM	>220 DIM	
1ST	0	0	0	—First lactation cows clean
OTHER	10	7	13	—Some older chronic cows
ALL	7	6	12	

YEARLY AVERAGE PERCENT SCC POSITIVE = 9

Figure 6. A herd in which mastitis is being controlled effectively.

Yearly SCC Summary

The yearly summary considers the percentage of infected cows or heifers relative to their stage of lactation. Determination of when the most infections occur during the lactation and in which group (heifers or cows) they are occurring most often will enable you to identify which management factors are the most likely cause of the herd mastitis problem.

Mastitis control in the herd described in figure 6 is good. Heifers are freshening free from mastitis and are remaining free of it throughout the lactation. There are a few older chronic cows in the herd that probably are being milked last. The management techniques being used to control the spread of mastitis in this herd probably include good milking equipment, recommended milking procedures, general sanitation, effective teat dipping, and dry cow therapy.

The herd described in figure 7 is experiencing a high incidence of mastitis in heifers soon after calving. Some possible reasons would include unsanitary heifer maternity facilities, udder edema, and calf sucking problems. In general, the level of mastitis in this herd, except for heifers fresh less than 30 days, is relatively good.

YEARLY SCC SUMMARY			
LACT NO	PCT POSITIVE OR V STRONG		
	<30 DIM	30-220 DIM	>220 DIM
1ST	42	1	0
OTHER	14	15	21
ALL	32	9	8

Figure 7. A herd experiencing a high incidence of mastitis in heifers soon after calving.

In such a case, searching for deficiencies in milking equipment, milking procedures, teat dipping, or dry cow therapy probably would be unproductive. Emphasizing heifer management should solve the problem.

The herd described in figure 8 demonstrates the typical pattern that develops when there are poor milking practices, marginal milking equipment, or the failure to teat dip or use dry cow therapy consistently. Any one of these circumstances or any combination of them can result in this type of pattern.

YEARLY SCC SUMMARY			
LACT NO	PCT POSITIVE OR V STRONG		
	<30 DIM	30-220 DIM	>220 DIM
1ST	0	46	60
OTHER	20	34	37
ALL	11	39	42

Figure 8. Typical pattern of mastitis increase when management practices are poor.

Note that the heifers in this herd begin their lactation, as expected, with no infection. As the lactation progresses, however, seemingly small deficiencies (failure to use separate towels to wash and dry, failure to teat dip consistently, allowing too many air slips, etc.) have the cumulative result of increasing the level of mastitis. By the end of the lactation, 60 percent of the heifers in this herd are infected. The owner of a herd with such a pattern needs to analyze milking equipment performance, milking procedures, teat dipping, sanitation, and dry cow therapy.

Herds with mastitis problems due to multiple management or equipment deficiences throughout the dry period and lactation may not show any of these typical patterns. In such cases, all aspects of mastitis control need serious consideration.

The yearly average percent SCC positive number, a computer printed statement in figure 6, indicates the accumulated percent of all sample day tests conducted during the past year that had a linear score of 5 or higher. It reflects the average situation for your herd during the past 12 months.

Problem Cow List

The upper right of the herd summary (figure 10) lists cows that have contributed a significant portion of the bulk tank somatic cells. The cow's name or number is at the left and the percentage of somatic cells in the bulk tank coming from the milk of that cow is at the right.

The two cows listed in figure 9 account for 40 percent of the SCC for a herd. Kelly is contributing more than a fourth of all cells, and Sally is contributing another 14 percent. Keeping Kelly's milk out of the tank would lower the herd average SCC significantly. If, for example, this herd had a herd average SCC of 365,000, removing Kelly's milk would lower it to 279,000.

If you are in the unfortunate situation of having a herd SCC that approaches 1.5 million, withholding the milk from a couple of cows often will reduce the bulk tank count and help ensure your ability to remain on the market.

LIST OF PROBLEM COWS WITH PERCENT HERD SCC		
Kelly .....26 Sally 14		

Figure 9. Cows contributing a high percentage of somatic cells.

Individual Cow Data

Individual cows are identified by name or number in the sixth column from the left on the SCC Summary (see figure 10). The column at the left is each cow's "computer control number." Age of cow (lactation number), stage of lactation (days in milk), and current month sample data (milk weight and linear SCC score) are listed in the next three columns. Any cow with a linear score of 4 should be *suspected* of being infected. Cows with a linear SCC score of 5 or more are considered to be infected (positive).

A "C" in the SCC Code column means this cow had a high somatic cell count for two or more consecutive months since calving. A "P" indicates the cow had a high SCC score during the previous lactation. An "N" means this cow has a new infection or has been reinfected after having had a linear score of 4 or less for two or more months.

The *number of new infections* is listed after the last line of cow data. Knowing the rate of new infections each month is helpful in determining whether your mastitis control program is working. If you have just begun some new mastitis control procedures, a decrease in new infections may indicate that they are having an effect. Any significant rise in the new infection rate may indicate a breakdown in mastitis control procedures or may indicate improperly functioning milking equipment.

Individual cow cell count data are useful in identifying problem cows and as an aid in making culling decisions. When possible, changing milking order so that high cell count cows are milked last is a good means of reducing the spread of contagious mastitis.

Monitoring the SCCs of individual cows at the end of lactation may aid in anticipating potential flareups during the early dry off period. Certainly the cow with a consistently high SCC late in lactation needs close observation during this critical period. Discuss appropriate drying off procedures and dry cow treatment with your veterinarian.

What About Treatment?

Obviously, all cases of clinical mastitis should be treated whenever they occur. Generally, however, it is unwise to treat subclinical mastitis (SCC linear score of 5 or more) during lactation. Treatment of most subclinical infections during lactation cannot be economically justified; the cost of treating cows and discarding the milk far outweighs the benefits. Using good milking procedures as well as teat dipping and dry cow treatment are the most sensible ways of attacking this problem. There is one exception to this general rule. If the subclinical mastitis is caused by the organism *Streptococcus agalactiae,* there is good chance that treatment during lactation will be effective. If you decide to treat a subclinical case of mastitis, the infected quarter must be identified (California Mastitis Test) and cultured to determine the causative agent as well as its drug sensitivity.

Using SCC for Control

Here is a suggested approach for establishing a control program using the SCC program:

1. Determine the severity of your mastitis problem.
2. If your herd average SCC is greater than 250,000 or the average yearly SCC percent positive or very strong is greater than 15 percent, review your mastitis control procedures and your milking equipment. Determine the nature of the infection by collecting aseptically and culturing a composite sample from cows with persistently high SCCs. Another way to characterize a herd mastitis problem is to collect aseptically and culture five consecutive bulk tank samples on special culture media. This procedure should be coordinated with your local veterinary clinic and processed through a veterinary diagnostic lab.
3. Review the control procedures you use. Start those practices you are not using.
4. Have the adequacy of your milking equipment operation checked twice each year.
5. Follow proper milking procedures.
6. Improve stall and lot sanitation and other practices, such as clipping the udder, that help keep the udder clean and dry.
7. Use effective teat dips and dry cow treatment routinely.
8. Treat all clinical cases and cull chronic nonresponding cows.
9. Minimize the spread of new infections by milking infected cows last.
10. Monitor the response of your control program by reviewing your SCC report monthly.

Evaluation of John Dairyman Herd

The John Dairyman herd (see figure 10) has a low herd average SCC (204,000). His estimated daily milk yield lost is calculated to total only $2,365 for the year if milk is valued at $12/cwt. (0.54 cwt × $12 × 365 days). One distressing concern about this herd is the increase in current infection rate (26% vs. 14% last month and 4% one year ago). Fifteen percent (4 cows) of his herd are newly infected since last sample day. This is considerably higher than his yearly average of 9 percent SCC positive.

By inspecting the data in the "Yearly SCC Summary" section, you must conclude that Mr. Dairyman is experiencing a high incidence of mastitis in his older cows soon after calving. All four of his newly infected cows have been fresh for fewer than 90 days. This may be the result of not consistently "dry treating" cows at the end of their previous lactation. Also there is the possibility that his "dry cows" were maintained in wet, dirty (unsanitary) conditions and contracted subclinical mastitis in this manner.

A sudden increase in infection rate is sometimes the result of a recent milking system malfunction. When this occurs, both first lactation and older cows are usually affected.

If Mr. Dairyman wishes to insure continuation of his low herd average SCC in order to qualify for a "quality bonus" on milk sold, he would be advised to keep the milk produced by "Pearl" out of the bulk tank and feed it to his calves. By withholding that milk, his herd average SCC would be expected to drop from 204,000 to 156,000 cells.

JOHN DAIRYMAN 101 HAECKER HALL ST PAUL MN 55108

HERD CODE 41-00-0082 | MAIL DATE 10-08-83

SCC SUMMARY

SOMATIC CELL COUNT
AN EFFECTIVE TOOL
IN MASTITIS CONTROL

SAMPLE DATE 10-04-83 | PAGE 1

CURRENT SCC SUMMARY

LACT NO	NUMBER COWS	NUMBER OF COWS ON SAMPLE DAY 0	1	2	3	4	5	6	7	8	9
1ST	3				3						
OTHER	24	6			8	3	3	3	1		
ALL	27	6			11	3	3	3	1		

HERD AVG SCC

CELLS	
204,000	
LINEAR	
3.1	

SCC TRENDS

LACT NO	PCT POSITIVE CURRENT	LAST MO	YR AGO
1ST	0	33	0
OTHER	29	12	5
ALL	26	14	4

YEARLY SCC SUMMARY

LACT NO	PCT POSITIVE ≤30 DIM	30-220 DIM	≥220 DIM
1ST	0	6	7
OTHER	20	6	13
ALL	19	6	11

LIST OF PROBLEM COWS WITH PERCENT HERD SCC

PEARL. 27
ELOISE 11
ANABEL 11

DAIRY HERD IMPROVEMENT DHI 222 9/83

ESTIMATED DAILY MILK YIELD LOST = 54 LBS

YEARLY AVERAGE PERCENT SCC POSITIVE = 9

PREVIOUS SAMPLE DAY MILK POUNDS AND SOMATIC CELL COUNTS (LINEAR SCALE - - - SEE BACKSIDE)

COMPUTER NUMBER	LACT NUMBER	DAYS IN MILK	CURRENT SAMPLE 10-04-83 MILK	SCC	SCC CODE	BARN NAME	SEP 8 26 DAYS AGO MILK	SCC	JUL 20 76 DAYS AGO MILK	SCC	JUN 3 123 DAYS AGO MILK	SCC	MAY 4 153 DAYS AGO MILK	SCC	APR 7 180 DAYS AGO MILK	SCC	MAR 5 213 DAYS AGO MILK	SCC	FEB 1 245 DAYS AGO MILK	SCC	JAN 8 269 DAYS AGO MILK	SCC	DEC 3 305 DAYS AGO MILK	SCC	NOV 3 335 DAYS AGO MILK	SCC	OCT 2 367 DAYS AGO MILK	SCC
0003	3	70	66	0		AGGIE	83	3																				
0001	4	15	86	5	NP	ALICE																						
0002	5	39	74	5	CP	ANABEL	76	7																				
0052	1	214	47	3		BETH	55	3	59	3	71	3	61	0	59	0												
0011	3	281	34	3	P	BIDDY	48	3	50	3	67	3	62	3	62	3	75	0	70	3	75	3						
0055	2	42	55	3		CANARY	61	4																				
0005	4	109	66	3	P	COLLEN	91	3	70	3																		
0056	5	30	80	4		COMET																						
0030	2	299	10	6	N	DIMS	37	3	57	3	77	4	80	3	80	3	92	3	96	3	91	0						
0037	3	41	58	6	CP	ELOISE	70	5																				
0053	1	190	46	3		EVA	73	3	66	3	88	0	79	0	67	3												
0026	3	120	45	3		FOBES	53	3	56	0																		
0054	1	67	39	3		KATE	23	8																				
0009	4	60	71	0		KATHY	74	3																				
0022	4	161	64	4		NEDA	79	0	90	3	111	4	90	6														
0049	3	35	89	0		OYE	59	4																				
0048	4	20	50	5	N	PACE																						
0012	3	313	11	6	C	PATTY	36	6	51	4	69	4	63	3	74	3	79	3	79	0	85	0	56	5				
0043	2	74	72	7	N	PEARL	75	3																				
0008	3	75	70	4	P	PEG	79	4																				
0050	2	94	97	3		PHOEBE	97	4	65	3																		
0024	2	326	38	0		PREME	47	0	49	3	56	3	58	3	60	0	73	0	62	3	67	4	73	0				
0045	2	196	76	0		PRIDE	84	3	91	0	120	4	96	0	47	0												
0051	2	226	43	3		RENE	57	6	64	0	70	0	71	3	49	0	54	3										
0047	2	217	60	3		SUE	75	3	95	3	115	0	113	0	99	0												
0013	4	152	65	3	P	45	76	4	95	3	92	5																
0020	3	49	71	0		57	107	3																				

NUMBER OF NEW INFECTIONS = 4 COWS (15 PCT OF COWS IN MILK)

Figure 10. John Dairyman herd SCC summary.