Using Test Day Data To Manage Udder Health And Milk Quality

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1

Brief Biography

- 1999 – 2001:   Agricultural apprenticeship
- 2001 – 2007:DVM, Ludwig-Maximilians-Universität, Munich, Germany
- 2007 – 2008:   Dissertation, Clinic for Ruminants, LMU, Munich,   Germany
- 2008 – 2013:   Clinical Instructor, Clinic for Ruminants, LMU, Munich,   Germany
- 2013 – 2015: Resident, Ambulatory and Production Medicine Clinic, Cornell University
- 2015 – 2017: Post-doc, QMPS, Cornell University
- 2017 -   Extension Associate, QMPS, Cornell University

2

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Take Home Message

1. Be able to explain what somatic cells are, how they are measured, and why they are important.

2. Be able to extract key performance indicators from DC305 and explain how they relate to udder health of specific groups in a herd.

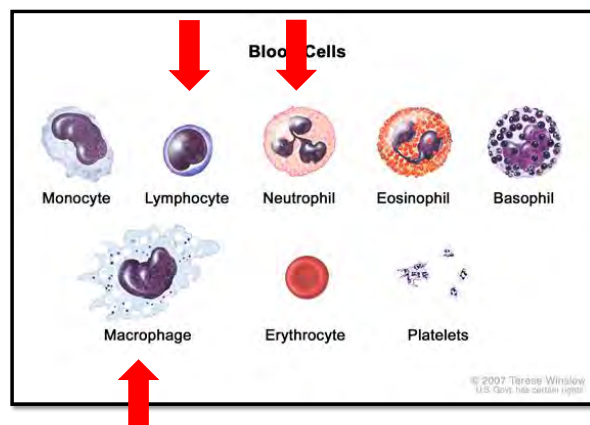3. Be able to take advantage of test day data to manage the bulk tank SCC.

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3

What are Somatic Cells in Milk?

- White blood cells/Leukocytes
  - **Poly**morphonuclear **n**eutrophils (PMN)
  - Macrophages
  - Lymphocytes
- Epithelial cells

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What are Somatic Cells in Milk?

Cell Population (%)	Mean	Standard Deviation	Minimum	Maximum
PMN	58.68	16.19	13	92
Macrophages	35.45	14.30	7	79
Lymphocytes	5.09	4.05	0	19

(Damm et al. 2017 – J. Dairy Sci. 100:4923-4940)

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5

How do we measure SCC in Milk?

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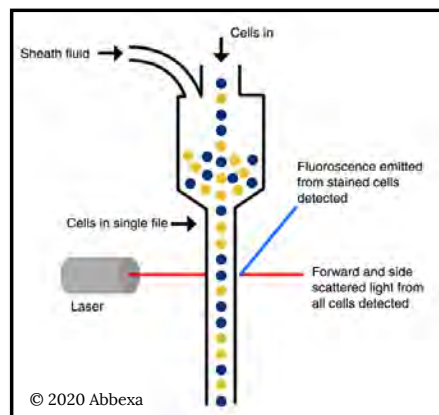
6

Why do we care about SCC in Milk?

- SCC ➡ Milk production   (Hadrich et al. 2018 – J. Dairy Sci. 100:3588-3596)
- SCC ➡ Premiums   (Ruegg 2011 – https://milkquality.wisc.edu/)
- SCC ➡ Milk casein and cheese yield   (Barbano et al. 1991 – J. Dairy Sci. 74:369-388)
- SCC ➡ Bimodal milk letdown   (Zecconi et al. 2018 – J. Dairy Res. 85:20-52)
- SCC   Animal well-being   (Peters et al. 2015 – Animal 9:2024-2028)

7

Transfer from SCC to Linear Score (LS)

- **Linear Score = ln[(SCC/100,000)/ln(2)] + 3**   (Ali and Shook. 1980 – J. Dairy Sci. 63:487-490)

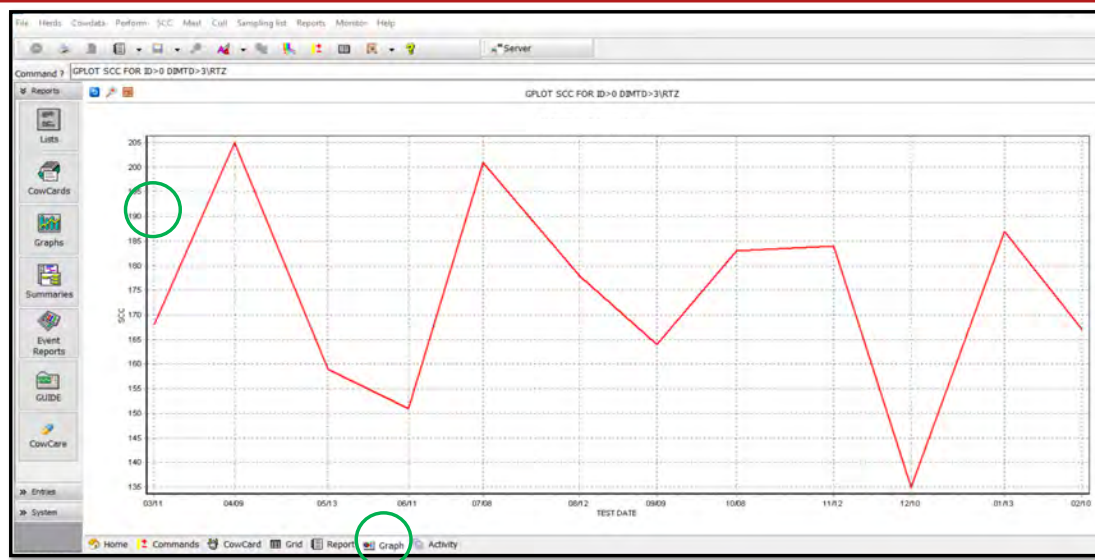| SCC (cells/mL)	Linear Score
400,000	5
200,000	4
100,000	3
25,000	1
12,500	0
12,000	-0.05
1,000	-3.6

8

Mean Test Day SCC I

- COMMAND: **GPLOT SCC FOR ID>0 DIMTD>3\RTZ**
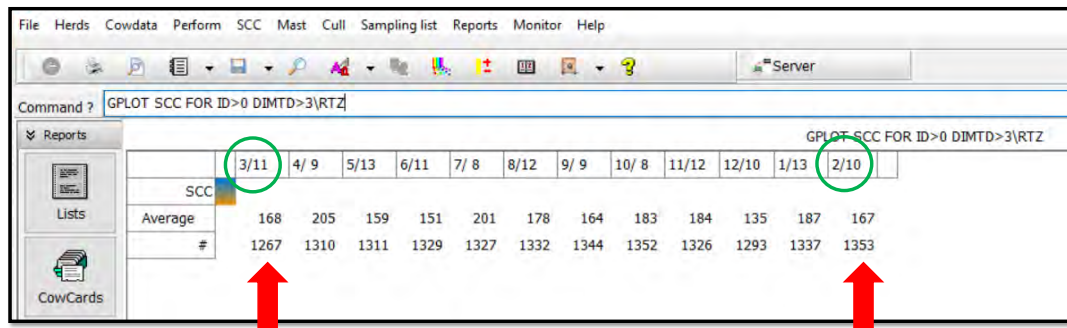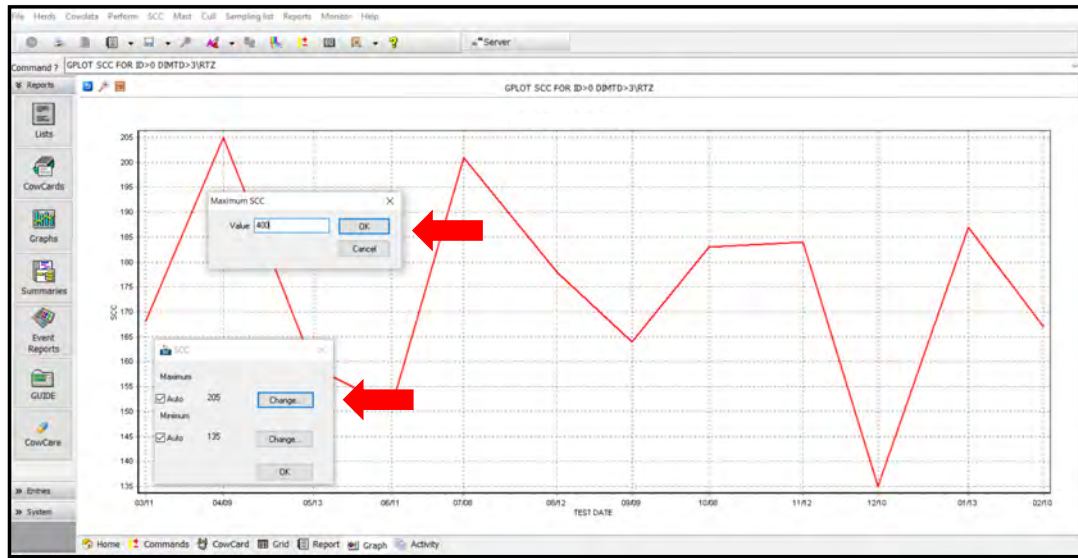

9

Mean Test Day SCC II

10

Mean Test Day SCC III

11

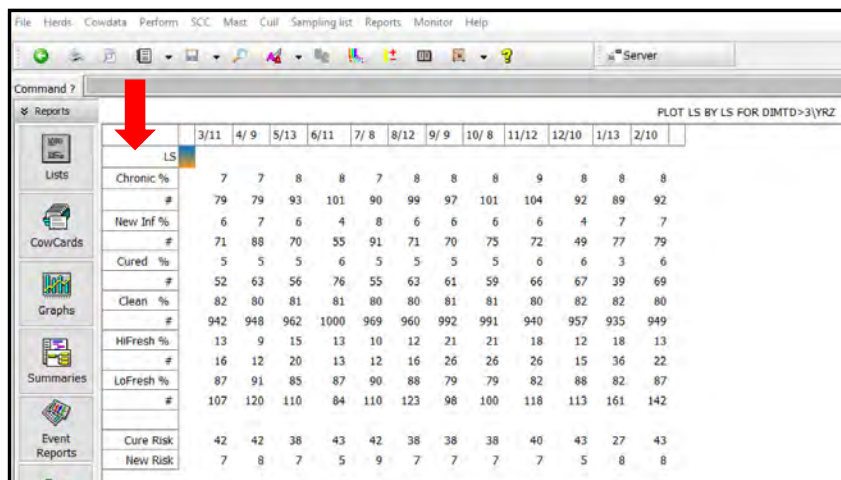## Mean Test Day SCC IV

12

13

14

Milk Quality Online Course

Apr 27, 2020

Key Performance Indicators II

1. Chronic % = $92/(92 + 79 + 69 + 949)$ = 8%

15

Key Performance Indicators III

1. Chronic % = $92/(92 + 79 + 69 + 949)$ = 8%
2. New Inf % = $79/(92 + 79 + 69 + 949)$ = 7%

16

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Key Performance Indicators IV

1. Chronic % = 92/(92 + 79 + 69 + 949) = 8%
2. New Inf % = 79/(92 + 79 + 69 + 949) = 7%
3. Cured % = 69/(92 + 79 + 69 + 949) = 6%

17

Key Performance Indicators V

1. Chronic % = 92/(92 + 79 + 69 + 949) = 8%
2. New Inf % = 79/(92 + 79 + 69 + 949) = 7%
3. Cured % = 69/(92 + 79 + 69 + 949) = 6%
4. Clean % = 949/(92 + 79 + 69 + 949) = 80%

18

Key Performance Indicators VI

1. Chronic % = 92/(92 + 79 + 69 + 949) = 8%
2. New Inf % = 79/(92 + 79 + 69 + 949) = 7%
3. Cured % = 69/(92 + 79 + 69 + 949) = 6%
4. Clean % = 949/(92 + 79 + 69 + 949) = 80%
5. HiFresh % = 22/(22 + 142) = 13%

19

Key Performance Indicators VII

1. Chronic % = 92/(92 + 79 + 69 + 949) = 8%
2. New Inf % = 79/(92 + 79 + 69 + 949) = 7%
3. Cured % = 69/(92 + 79 + 69 + 949) = 6%
4. Clean % = 949/(92 + 79 + 69 + 949) = 80%
5. HiFresh % = 22/(22 + 142) = 13%
6. LoFresh % = 142/(22 + 142) = 87%

20

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Key Performance Indicators VIII

1. Chronic % = 92/(92 + 79 + 69 + 949) = 8%
2. New Inf % = 79/(92 + 79 + 69 + 949) = 7%
3. Cured % = 69/(92 + 79 + 69 + 949) = 6%
4. Clean % = 949/(92 + 79 + 69 + 949) = 80%
5. HiFresh % = 22/(22 + 142) = 13%
6. LoFresh % = 142/(22 + 142) = 87%
7. Cure Risk = **69**/(**77** + **89**) = 42%

21

Key Performance Indicators IX

1. Chronic % = 92/(92 + 79 + 69 + 949) = 8%
2. New Inf % = 79/(92 + 79 + 69 + 949) = 7%
3. Cured % = 69/(92 + 79 + 69 + 949) = 6%
4. Clean % = 949/(92 + 79 + 69 + 949) = 80%
5. HiFresh % = 22/(22 + 142) = 13%
6. LoFresh % = 142/(22 + 142) = 87%
7. Cure Risk = 69/(77 + 89) = 42%
8. New Risk = **79**/(**39** + **935**) = 8%

22

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Key Performance Indicators IX

1. Chronic % = 92/(92 + 79 + 69 + 949) = 8%
2. New Inf % = 79/(92 + 79 + 69 + 949) = 7%
3. Cured % = 69/(92 + 79 + 69 + 949) = 6%
4. Clean % = 949/(92 + 79 + 69 + 949) = 80%
5. HiFresh % = 22/(22 + 142) = 13%
6. LoFresh % = 142/(22 + 142) = 87%
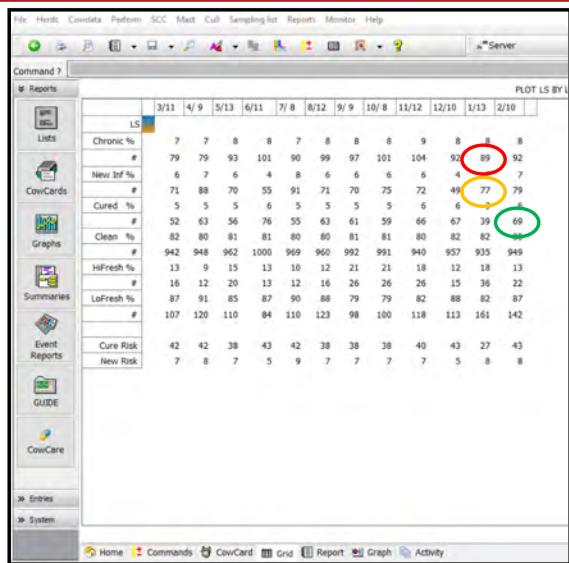7. Cure Risk = 69/(77 + 89) = 42%
8. New Risk = 79/(39 + 935) = 8%

23

New Inf % – New Risk

	March	April	May	June
Farm A				
Chronic #	50	50		
New Inf #	0	10		
Cured #	0	0		
Clean #	50	40		
Farm B				
Chronic #	1	1		
New Inf #	0	10		
Cured #	0	0		
Clean #	99	89		

1. Farm A
   1. New Inf % = 10/100 = 10%
   2. New Risk = 10/50 = 20%
2. Farm B
   1. New Inf % = 10/100 = 10%
   2. New Risk = 10/99 = 10%

24

New Inf % – New Risk

	March	April	May	June
Farm A				
Chronic #	50	50	60	
New Inf #	0	10	10	
Cured #	0	0	0	
Clean #	50	40	30	
Farm B				
Chronic #	1	1	1	
New Inf #	0	10	10	
Cured #	0	0	10	
Clean #	99	89	79	

1. Farm A
   1. New Inf % = 10/100 = 10%
   2. New Risk = 10/40 = 25%
2. Farm B
   1. New Inf % = 10/100 = 10%
   2. New Risk = 10/89 = 11%

25

New Inf % – New Risk

	March	April	May	June
Farm A				
Chronic #	50	50	60	70
New Inf #	0	10	10	10
Cured #	0	0	0	0
Clean #	50	40	30	20
Farm B				
Chronic #	1	1	1	1
New Inf #	0	10	10	10
Cured #	0	0	10	10
Clean #	99	89	79	79

1. Farm A
   1. New Inf % = 10/100 = 10%
   2. New Risk = 10/30 = 33%
2. Farm B
   1. New Inf % = 10/100 = 10%
   2. New Risk = 10/89 = 11%

26

New Inf % – New Risk

	March	April	May	June
Farm A				
Chronic #	50	50	60	70
New Inf #	0	10	10	10
Cured #	0	0	0	0
Clean #	50	40	30	20
Farm B				
Chronic #	1	1	1	1
New Inf #	0	10	10	10
Cured #	0	0	10	10
Clean #	99	89	79	79

	March	April	May	June
Farm A				
New Inf %	0	10	10	10
New Risk	-	20	25	33
Farm B				
New Inf %	0	10	10	10
New Risk	0	10	11	11

27

Key Performance Indicators X

28

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Key Performance Indicators XI
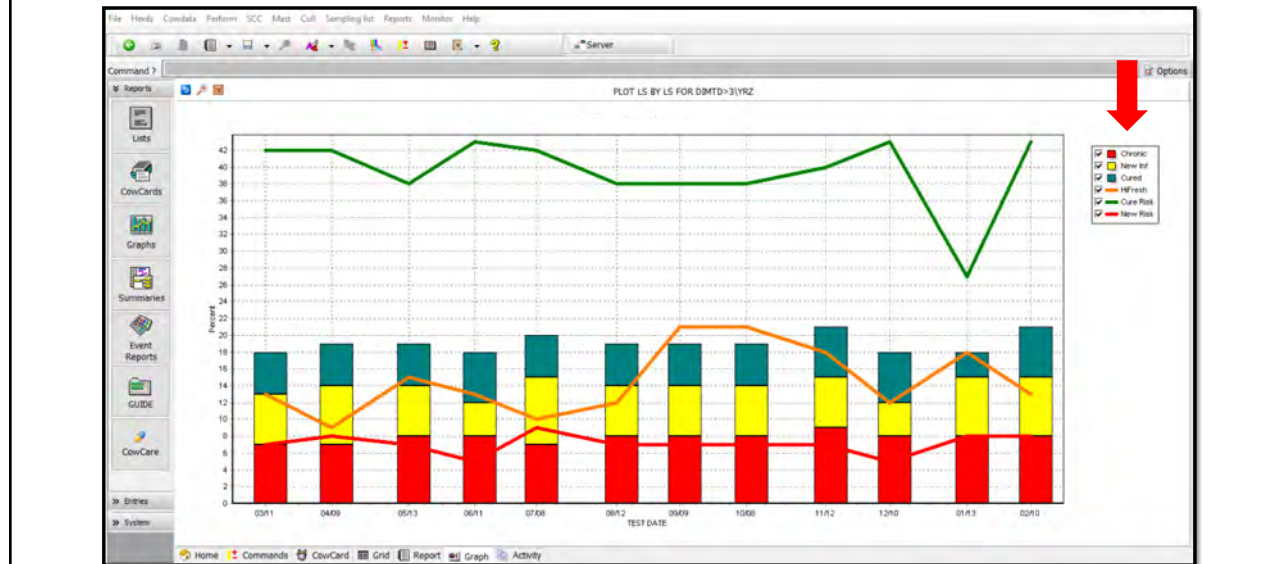
29

KPI – New Infection Risk I

30
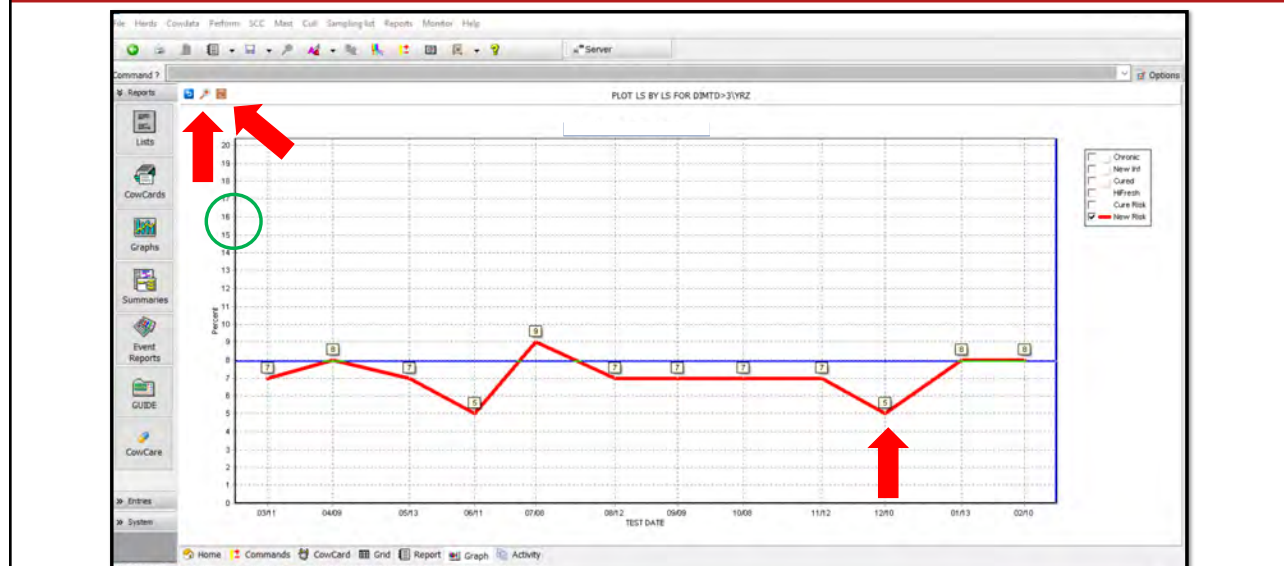
KPI – New Infection Risk II
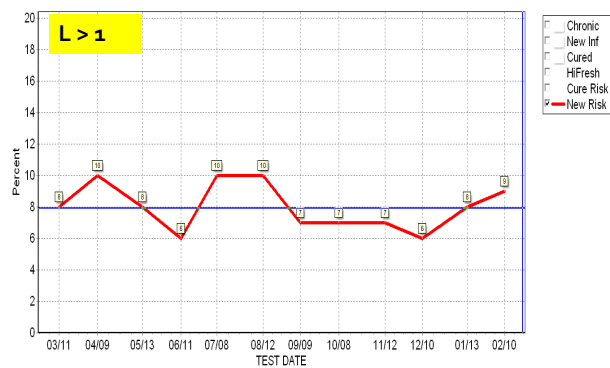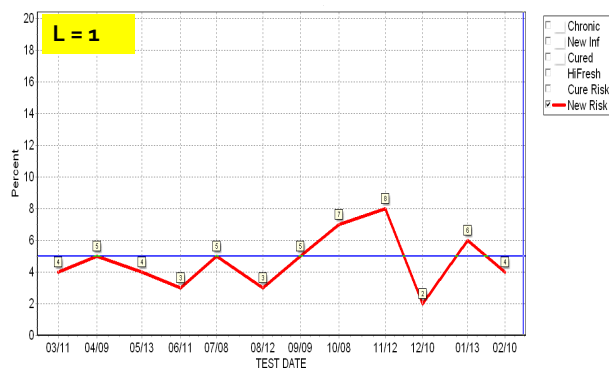
31

KPI – % Chronic and Cure Risk I
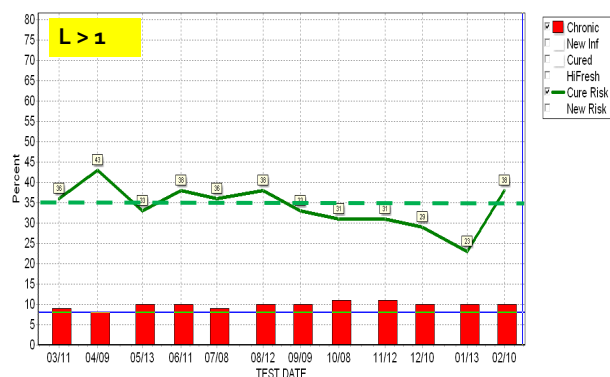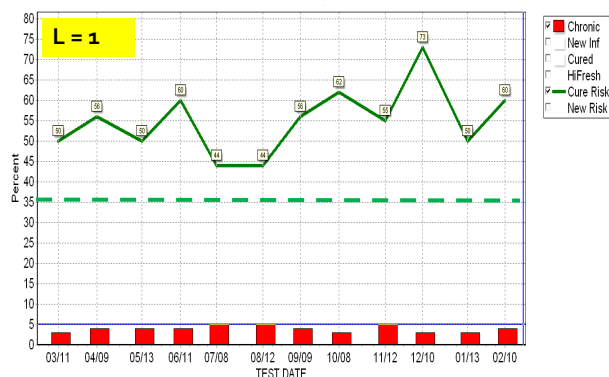
32

KPI – % High Fresh I
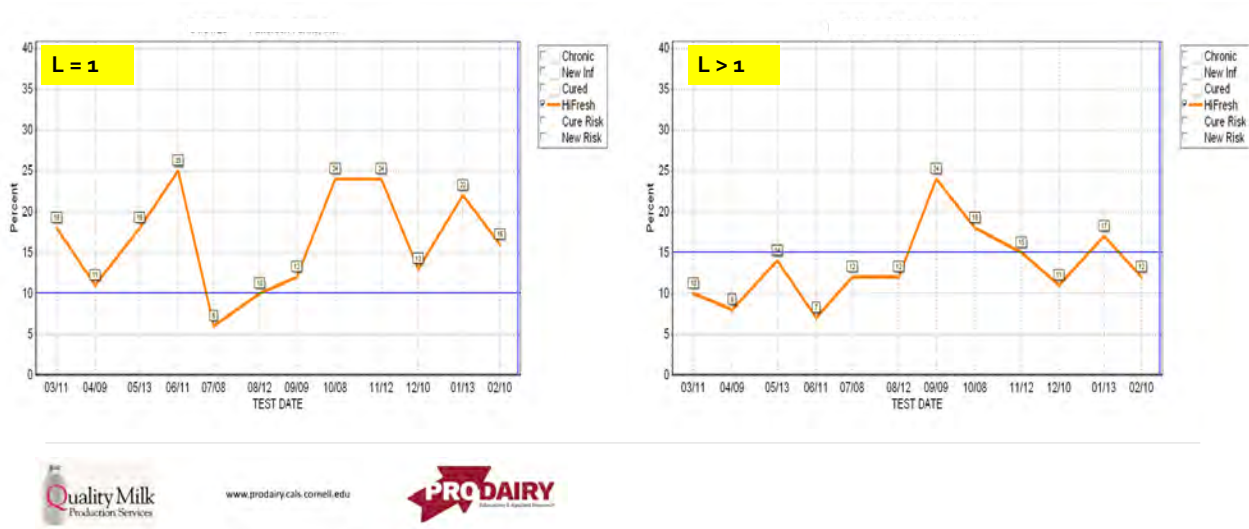
33

Dry Cow Data I

COMMAND: EVENTS\7S DRYLS

34

Dry Cow Data II

• COMMAND: **SUM DRYLS=4 LS1=4 FOR LACT>0 DRYLS>0 LS1>0 DIMTD>3**

35

Dry Cow Data III

• COMMAND: **SUM DRYLS=4 LS1=4 FOR LACT>0 DRYLS>0 LS1>0 DIMTD>3**

1. % Cure = **134**/**153***100 = 88%

36

Dry Cow Data IV

- COMMAND: **SUM DRYLS=4 LS1=4 FOR LACT>0 DRYLS>0 LS1>0 DIMTD>3**

1. % Cure = 134/153*100 = 88%
2. % New Infections = **89**/**781***100 = 11%

37

Dry Cow Data V

- COMMAND: **SUM DRYLS=4 LS1=4 FOR LACT>0 DRYLS>0 LS1>0 DIMTD>3**

1. % Cure = 134/153*100 = 88%
2. % New Infections = 89/781*100 = 11%
3. % Chronic = **19**/**934***100 = **2%**

38

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Dry Cow Data VI

- COMMAND: **SUM DRYLS=4 LS1=4 FOR LACT>0 DRYLS>0 LS1>0 DIMTD>3**

1. % Cure = 134/153*100 = 88%
2. % New Infections = 89/781*100 = 11%
3. % Chronic = 19/934*100 = 2%
4. New infection corrected cure =
   $$((134/(1-0.11))/153)*100 = 98\%$$

39

Dry Cow Data VII

- COMMAND: **SUM DRYLS=4 LS1=4 FOR LACT>0 DRYLS>0 LS1>0 DIMTD>3**

1. % Cure = 134/153*100 = 88%
2. % New Infections = 89/781*100 = 11%
3. % Chronic = 19/934*100 = 2%
4. New infection corrected cure =
   $$((134/(1-0.11))/153)*100 = 98\%$$

Limitation of new infection corrected cure:
- what if % new infections = **20%**
- $((134/(1-0.20))/153)*100 = 109\%$

40

Dry Cow Data VIII

- **SUM DRYLS=4 LS1=4 <u>BY MOFSH</u> FOR LACT>0 DRYLS>0 LS1>0 DIMTD>3**

May 2019

41

Dry Cow Data IX

Dry Cow New Infection Risk by Fresh Date

42

Dry Cow Data X

Dry Cow Corrected Cure and Percent Chronic by Fresh Date
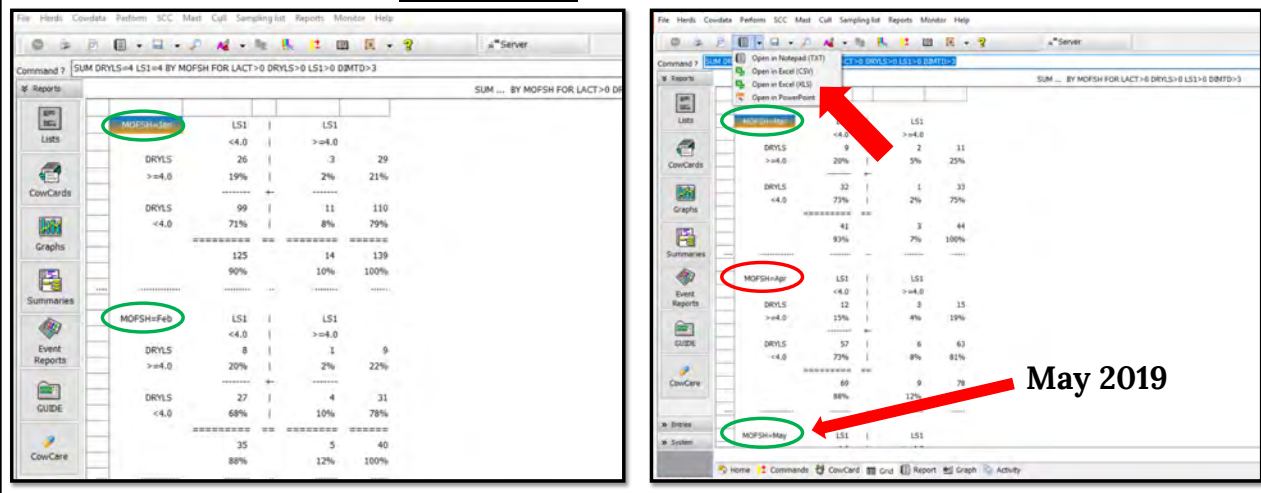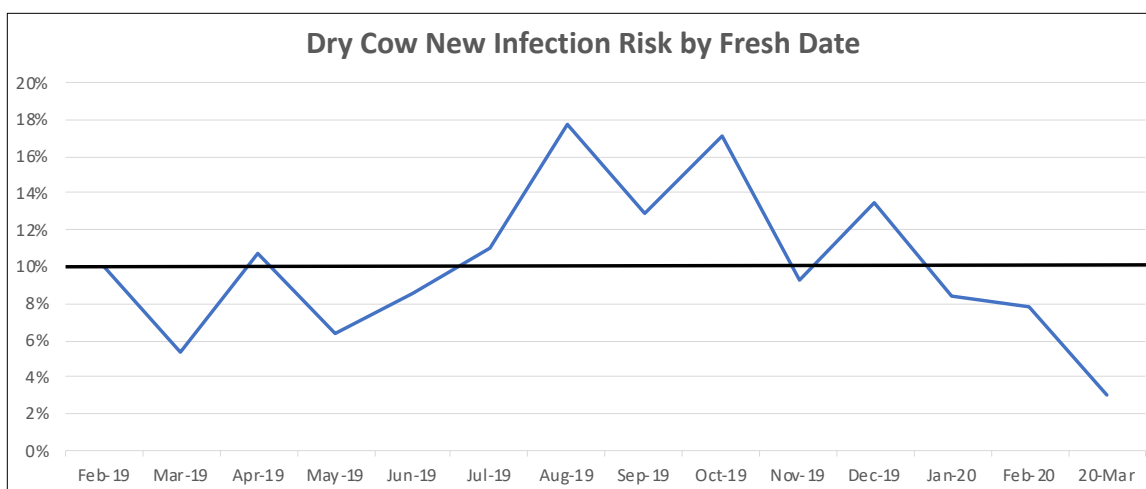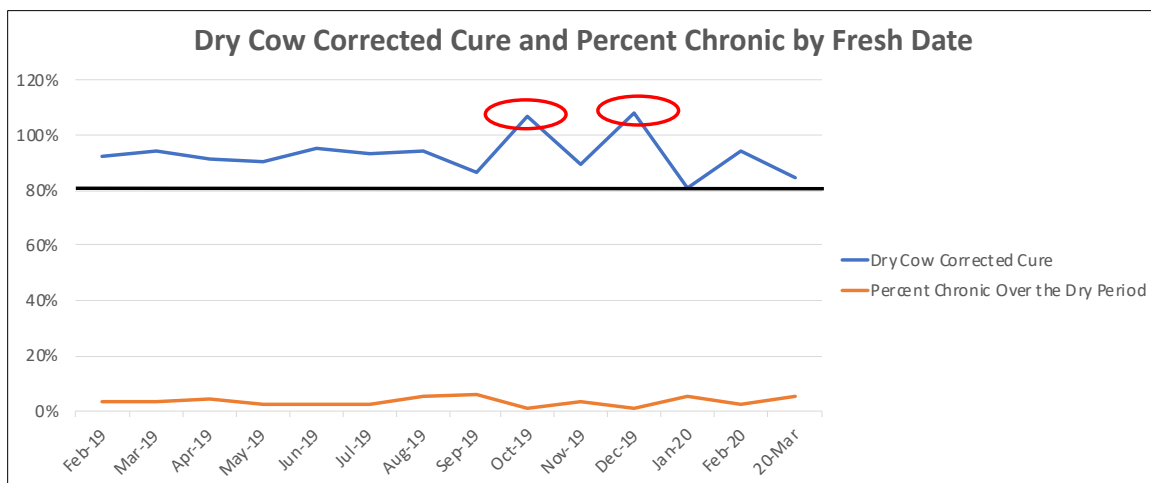
43

California Mastitis Test - Protocol

- **Step 1:** Take about 1 teaspoon (2 cc) milk from each quarter
- **Step 2:** Add an equal amount of CMT solution to each cup in the paddle
- **Step 3:** Rotate the CMT paddle in a circular motion to thoroughly mix the contents. Do not mix more than 10 seconds.
- **Step 4:** Read the test quickly. Visible reaction disintegrates after about 20 seconds. The reaction is scored visually. The more get formation, the higher the score.

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44

California Mastitis Test - Interpretation

- N = Negative
  - No infections/inflammation. No thickening of the mixture, <100,000 cells/mL
- T = Trace
  - Possible infections/inflammation. Slight thickening of the mixture. Trace reaction seems to disappear with continued rotation of the paddle. Approx. 300,000 cells/mL
  - Example: If all four quarters read trace there is no infection. If one or two quarters read trace, infections are possible.
- 1 = Weak Positive
  - Infection/Inflammation present. Distinct thickening of the mixture, but no tendency to form a gel. If CMT paddle is rotated more than 20 seconds, thickening may disappear. Approx. 900,000 cells/mL
- 2 = Distinct Positive
  - Infection/Inflammation present. Immediate thickening of the mixture, with a slight gel formation. As mixture is swirled, it moves toward the center of the cup, exposing the bottom of the outer edge. When motion stops, mixture levels out and covers bottom of the cup. Approx. 2.7 million cells/mL
- 3 = Strong Positive
  - Infection/Inflammation present. Gel is formed and surface of the mixture becomes elevated (like a fried egg). Central peak remains projected even after the CMT paddle rotation is stopped. Approx. 8.1 million cells/mL

University of Wisconsin: Pam Ruegg https://milkquality.webhosting.cals.wisc.edu/wpcontent/uploads/sites/212/2011/09/california-mastitis-test-fact-sheet.pdf
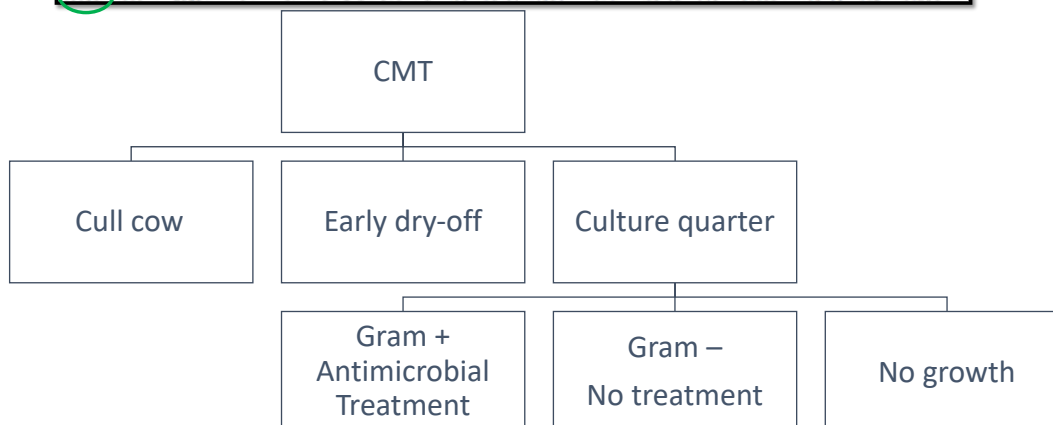
45

Managing High SCC Cows I

- COMMAND: **ECON ID DIM RPRO NMAST DCC PLS3 PLS LS\ST**

46

Managing High SCC Cows II

ID	DIM	RPRO	NMAST	DCC	PLS3	PLS	LS	#>4	MILK	Value	SCC	%Tank	Bulk Tank after removing only this cow from tank Price @SCC Income	Bulk Tank after removing cow and all cows above it Price @SCC Income
8547	194	SLD/DIE	0	121	4.1	8.7	8.9	4	84	10.21	5972	2.9	13.15 148 14821	13.15 148 14821
8558	183	SLD/DIE	0	0	7.5	8.3	9.5	6	49	5.95	9701	2.7	13.15 149 14826	13.15 144 14815
8512	87	OK/OPEN	0	0	0	2.8	8.1	1	127	15.43	3430	2.5	13.15 149 14816	13.15 141 14798

```
                    ┌──────────┐
                    │   CMT    │
                    └────┬─────┘
          ┌──────────────┼──────────────┐
    ┌──────────┐  ┌──────────────┐  ┌────────────────┐
    │ Cull cow │  │ Early dry-off│  │ Culture quarter│
    └──────────┘  └──────────────┘  └────────────────┘
                          ┌───────────────┼───────────────┐
              ┌──────────────────┐ ┌──────────────┐ ┌──────────────┐
              │     Gram +       │ │   Gram –     │ │  No growth   │
              │  Antimicrobial   │ │ No treatment │ │              │
              │   Treatment      │ │              │ │              │
              └──────────────────┘ └──────────────┘ └──────────────┘
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47

48

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