# Selective Dry Cow Therapy: Research and Practical Advice

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**M**

## UNIVERSITY OF MINNESOTA

# Dry Cow Therapy (DCT)

- Blanket Approach – all quarters of all cows treated with a long-acting intramammary antibiotic at dry off
  - Widely adopted as part of mastitis control plans since the 1960s (~80% of farms)
- Selective Approach - antibiotic DCT is reserved for cows or quarters known or suspected of being infected at dry off
  - Cows/quarters that are unlikely to be infected don't get antibiotics! (~10% of farms)

# Justification for Blanket DCT?

**Historical**

- Higher prevalence of contagious pathogens
    - Staph aureus, Strep agalactaie
- Higher prevalence of infection at dry off
- No validated tests to detect infection at dry off
- No way to protect against new infections over the dry period

Ruegg 2012; Arruda et al. 2013; Rowe et al. 2019

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**Current**

- Low prevalence of contagious pathogens
  - (in most herds)
- Low prevalence of infection at dry off (~19-35%)
- Regular DHIA testing and rapid culture
- Internal teat sealants highly effective at protecting against new infection
- Pressure to practice antibiotic stewardship!

Ruegg 2012; Arruda et al. 2013; Rowe et al. 2019

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  - Cows/quarters that are unlikely to be infected don't get antibiotics! (~10% of farms)

**Internal teat sealant is used in quarters that do not receive antibiotics!**

# Research Round Up

# Research Team



- Sandra Godden, DVM, DVSc, UMN CVM
- Luciano Caixeta, DVM, PhD, UMN CVM
- Sam Rowe, BVSc MVM PhD Dipl. ABVP MANZCVS, The University of Sidney
- Jennifer Timmerman, Lab for Udder Health, UMN CVM
- Emily Leonard, DVM Candidate, UMN CVM
- Felipe Pena Mosca, DVM, MSc, PhD Candidate, UMN CVM
- Monika Dzuiba, DVM/MS Candidate, Michigan State University
- Many other students, participating farms, and industry sponsors!

# UMN Selective Dry Cow Study 2018

#1 Blanket DCT vs. Culture- or Algorithm-guided SDCT

   – (Rowe et al., JDS 2020)

- 1275 cows in 7 herds from 4 sites
  - Bulk milk SCC < 250,000
  - Control of contagious mastitis pathogens
  - Excellent infusion technique
  - Using an internal teat sealant

Culture-guided SDCT

Algorithm-guided SDCT

Slide courtesy of Dr. Sam Rowe

# UMN Selective Dry Cow Study 2018

- Results:
  - Antibiotic use reduced by 55%
  - No negative health impacts
    - Similar cures and new infections over the dry period, infections post-calving
  - Similar SCC, clinical mastitis, milk yield, culling and death in next lactation
- Results consistent with other recent trials!
  - Kabera 2020, Vasquez 2018, Cameron 2014, 2015



Culture-guided SDCT



Algorithm-guided SDCT

# UMN SDCT Study - additional research

- #2 Evaluation of rapid culture, a predictive algorithm, an esterase strip measuring SCC, and a cow-side LDH test to detect infection in cows at dry off

- Results
  - Algorithm, esterase SCC and LDH test had poor agreement with reference test (lab culture); rapid culture had fair agreement
  - *Negative predictive values* were moderate to high (high % of negative tests were truly not infected)

# UMN SDCT Study - additional research

- #3 Compare 4 cow-level algorithms to predict infection status at dry off, and estimate the effect if used in a SDCT program

| Algorithm | Criteria for Low Risk Status (no antibiotic DCT) |
| --- | --- |
| Netherlands | Lact=1: SCC<150,00 last test. Lact≥2: SCC<50,00 last test. Last test within 6 weeks of dry off. |
| New Zealand | Lact=1:SCC<120,000 all tests. Lact≥2: SCC <150,000 all tests. No clinical mastitis whole lactation. |
| UK | SCC<200,000 last 3 tests. No clinical mastitis same period. |
| US | SCC<200,000 all tests, <2 cases clinical mastitis whole lactation. |

# UMN SDCT Study - additional research

- #3 Compare 4 cow-level algorithms to predict infection status at dry off, and estimate the effect if used in a SDCT program

- Results:
  - All algorithms have poor correlation to true infection status determined by culture; better for major pathogens
  - High Negative Predictive Values = if the cow does not meet criteria for treatment, there's a good chance she's not infected
  - Likely to work fine in a SDCT Program (assuming low prevalence of infection at dry off)!

# Different algorithms?

- Choose an algorithm that meets farm goals!
  - Maximize reduction in antibiotics – few false positives
    - For example, higher SCC thresholds, limited time frame
  - Minimize risk of missing an infection – few false negatives
    - For example, lower SCC thresholds, longer time frame

- Consider the risk level. Work with a veterinarian to select an appropriate algorithm.

# UMN SDCT Study - additional research

- #4 Does success of culture or algorithm SDCT vary by milk production level at dry off?
  - Combined data from UMN study and Canadian study (Kabera et al, 2020) – 1,484 cows
  - Cows classified as low (<23.7kg), mid (23.7-30.4kg), or high (>30.4kg) producing at dry off
- Results
  - Measures of udder health were not different in SDCT vs. Blanket across all production categories
  - **\*SDCT can be successfully implemented in cows of all production levels\***

# UMN SDCT Study - additional research

- #5 Partial budget analysis of culture and algorithm SDCT
- Results: Likely to be cost-effective in the average herd (Rowe 2020)
  - Algorithm > Culture
  - Most advantageous in herds that:
    - Use relatively expensive DCT products
    - Substantially reduce antibiotic use with SDCT
    - Implement SDCT without causing udder health problems
- Cost calculator:
  - https://dairyknow.umn.edu/research/udder-health/selective-dry-cow-therapy-cost-calculator/

Ave savings per cow dried off: $7.85 algorithm, $2.85 culture

# Selective Dry Cow Therapy Cost Calculator

Enter your information below to compare the cost of dry cow therapy strategies in your herd

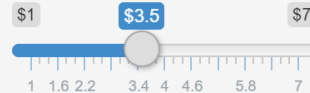## Number of cows dried off per year
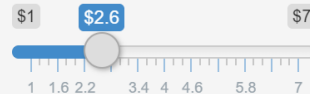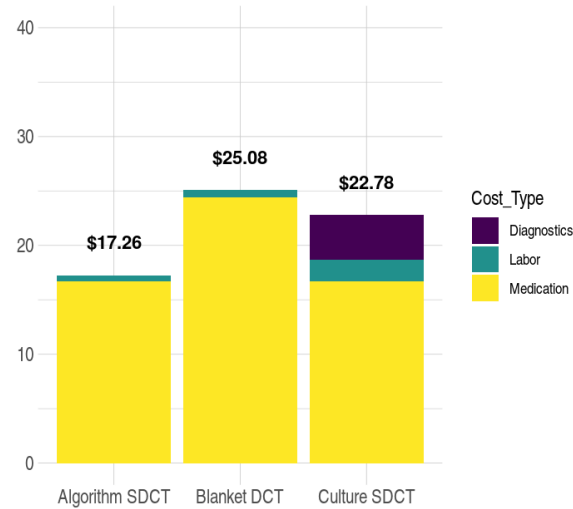
0

## Do you conduct monthly DHI tests?

◉ Yes
○ No

**Cost of dry cow therapy tubes ($/tube)**

$1    $3.5    $7

1   1.6   2.2   3.4   4   4.6   5.8   7

**Cost of internal teat sealant ($/tube)**

$1    $2.6    $7

1   1.6   2.2   3.4   4   4.6   5.8   7

## Cost ($) of each dry cow therapy approach

$17.26 — Algorithm SDCT
$25.08 — Blanket DCT
$22.78 — Culture SDCT

Cost_Type
- Diagnostics
- Labor
- Medication

### Culture SDCT

Culture-guided selective DCT will cost **$2.30 LESS** per dry-off than blanket DCT. The estimated annual cash impact on your farm is **+$0.00**

### Algorithm SDCT

Algorithm-guided selective DCT will cost **$7.82 LESS** per dry-off than blanket DCT. The estimated annual cash impact on your farm is **+$0.00**

# UMN Pilot Study – Refining Culture-Guided SDCT[6]

- Previous SDCT programs do not differentiate between infections
  - Not all mastitis benefits from antibiotic therapy

- Common dry period mastitis pathogens:
  - Coliforms: rare in late lactation (<2%), high spontaneous cure rate[1-3]
  - Non-aureus Staph. (NAS): transient, high spontaneous cure rate[1-4]
  - Other Gram-Positives: low frequency, many do not respond to antibiotic therapy[1-3]
  - Staph. aureus: rare (<1%), well managed by bulk tank surveillance or routine culture of clinical and chronic cases[1-3]
  - Strep. spp or Strep.-like organisms (SSLO): affect 2-8% of quarters, cause significant losses during lactation, do benefit from antibiotic therapy[1-5]

[1]Arruda 2013; [2]Johnson 2015; [3]Rowe 2019; [4]Rabiee 2013; [5]Oliveira 2013; [6]Leonard et al., AABP 2022

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  - Other Gram-Positives: ~~~~~~~~~~~~~~ any do not respond to antibiotic therapy[1-3]

  **Our target:**

  - Staph. aureus: rare (<1%), well managed by bulk tank surveillance or routine culture of clinical and chronic cases[1-3]
  - **Strep. spp or Strep.-like organisms (SSLO):** affect 2-8% of quarters, cause significant losses during lactation, do benefit from antibiotic therapy[1-5]

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# Conclusions

- **Spontaneous cure rates** for non-SSLO infections were high during the dry period

- Culture-guided **SDCT** program targeting SSLO (vs BDCT):

→ Similar or better **IMI dynamics** during the dry period

→ Similar **future health and performance** in early lactation

→ Reduced **antibiotic use** at dry-off by **83%**

Proves to be an **effective way to further enhance antimicrobial stewardship** on dairy farms

# Do we even need DCT?

- Another study! Blanket DCT vs. No DCT
  - 1 SD herd, 2,439 multiparous cows followed to 200DIM
- Results
  - No DCT = higher risk of culling during the dry period, higher risk of clinical mastitis in first 200d lactation
  - No differences between parity groups, previous mastitis history, dry period length

# Key points from the research

- DCT is still a good idea
- SDCT is good antibiotic stewardship
  - Reduce antibiotic DCT by 20-47% at cow level; 70-80% at quarter level
  - No negative impact on udder health or performance in next lactation
- Multiple approaches
  - Culture- or Algorithm-guided (multiple algorithms)
  - Possibly other cow-side tests
- Profitable for most dairies

# Practical Advice & Implementation

# Herd-level criteria for SDCT

- Low prevalence of infection at dry off (BTSCC < 250,000 cells/ml)
- Control of contagious pathogens
- Proper use of teat sealant
- Well-trained personnel to perform cow selection and dry off procedures (CLEAN)
- Ability to monitor outcomes

# Reduce infection, lower BTSCC

- Environment is #1
  - Bedding
  - Dry cow pen
- Chronic cows
- Milking parlor
- Milking equipment



The Mastitis Triangle
Cow
Milker    Machine
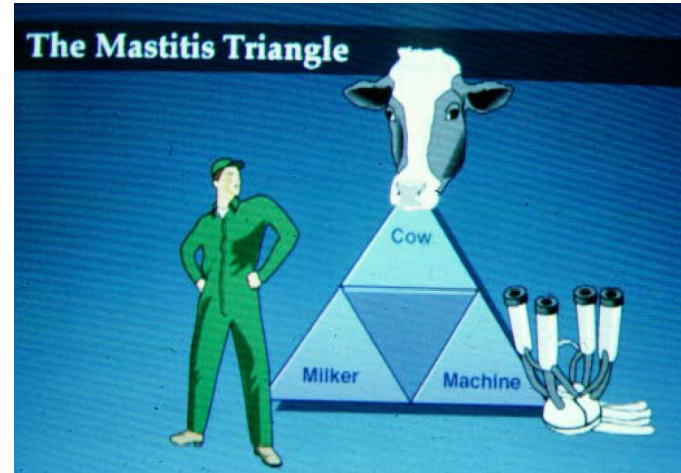
# Contagious mastitis control

- Herd biosecurity
- Testing strategy to find and eliminate infections
- Reduce risk of transmission within the herd

# Screening strategies

- Bulk milk screening (culture or PCR)
  - Monthly, or at minimum, quarterly
- Regular diagnosis of clinical mastitis
  - Targets cows most likely to be infected
  - Dual benefit of informing treatment decisions
- Screening fresh cows
  - Convenience sample, whole herd tested ~yearly
  - Targets fresh heifers who may bring new pathogens in

# Reduce Risk of Transmission

- Excellent milking-time hygiene
- Proper milking equipment function and maintenance
- Fly control
- Teat skin condition care and monitoring
- ID and eliminate, or at least segregate, contagious *and chronic* infections
- Good nutrition, strong immunity, low stress!

# Excellence at dry-off

- Intramammary infusion technique must be excellent!

- Internal Teat Sealants protect untreated quarters from new infections over the dry period
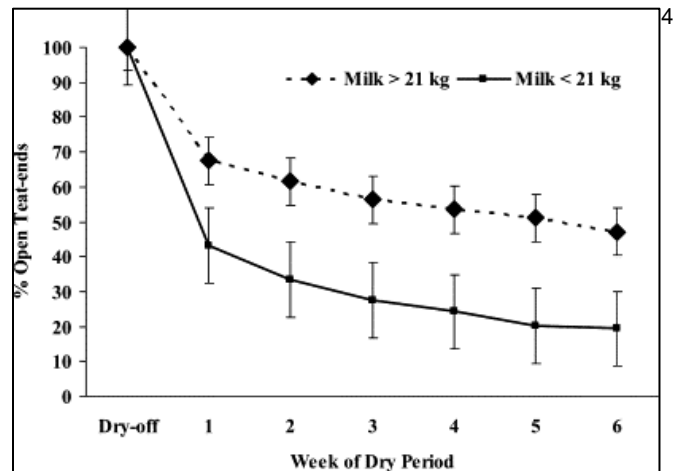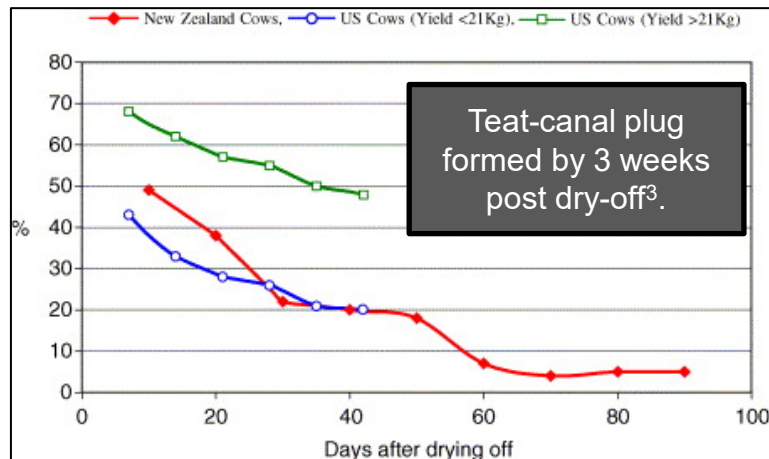  - Can introduce new infections if hygiene is not excellent!
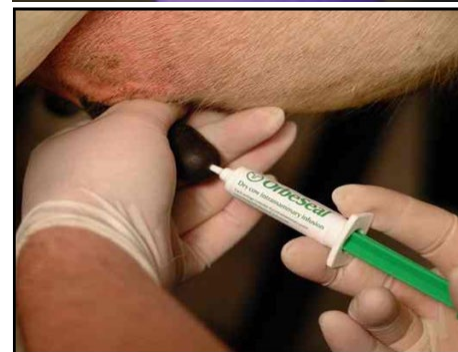
# Excellent dry-off personnel

- Who makes the dry-off decisions and does the drying off on your dairy?
  - Bought in to SDCT
  - Understands the importance of hygiene
  - Has the tools and training to do the job right
  - Accountable for outcomes

# Challenge at dry-off: many cows are still producing a lot of milk

- The National Mastitis Council recommends milk production to be below 33 lb/d before dry-off.
- Increased milk production at dry-off is associated with the risk of environmental IMI at calving[2].
  - Delayed formation of teat-canal keratin plug; Leaking milk, increased intramammary pressure



Teat-canal plug formed by 3 weeks post dry-off[3].

[2]Rajala-Schultz et al. (2005); [3]Bradley and Green (2004); [4]Dingwell et al. (2004)

# Strategies to decrease milk production before dry-off

Decrease milking frequency

Decrease quantity or quality of feed

Use of acidogenic bolus at dry-off
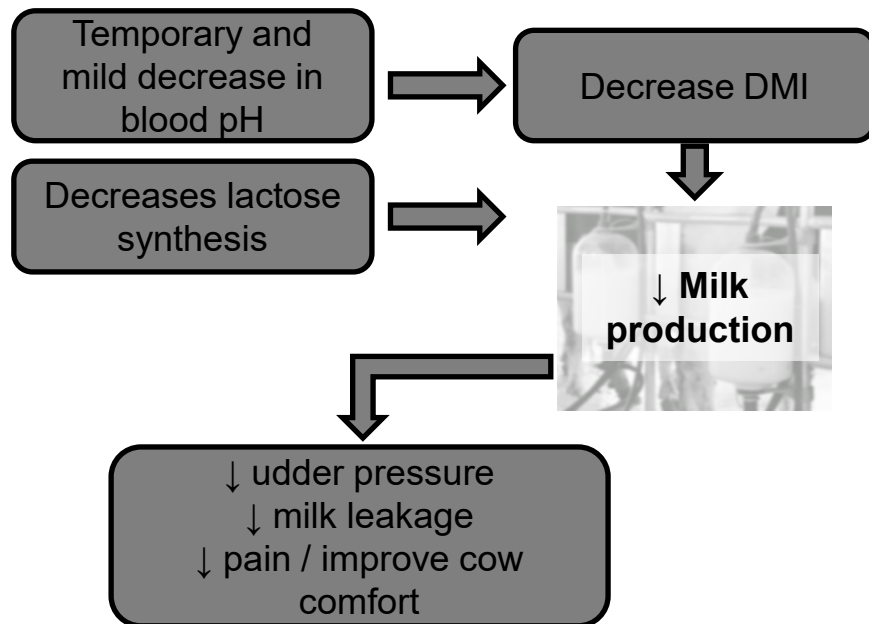
20% less milk[5]

34%[5] to 59%[6] less milk

10% less milk[8]

[5]Tucker et al. (2009); [6]Ollier et al. (2014); [7]Bach et al. (2015); [8]Maynou et al. (2018)

# What is an acidogenic bolus?



Maynou et al, JDS 2018 - demonstrated temporary decrease in urine pH, DMI, milk yield, and udder pressure and increased lying time.

Temporary and mild decrease in blood pH → Decrease DMI

Decreases lactose synthesis →

↓ Milk production

↓ udder pressure
↓ milk leakage
↓ pain / improve cow comfort

# Conclusions: Benefits of administration of Bovikalc® Dry (BKD) at dry-off:

- Decreased new intramammary infection during dry period
- Lactation performance:
  - Reduced SCC score during the first 70 DIM
  - Reduced clinical mastitis incidence
  - No impact on milk production
- Improved welfare (comfort) after dry-off:
  - Decreased standing time for 7 days post dry-off
  - No impact on rumination activity
- Economic analysis: Increased profitability for BKD group varying according to herd and follow up period.
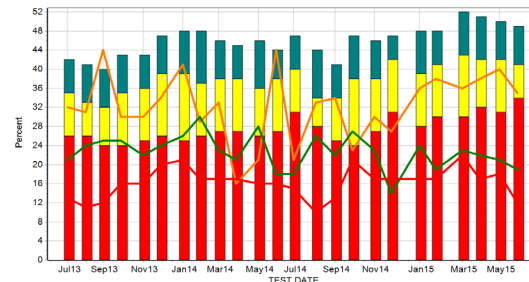
# Monitoring
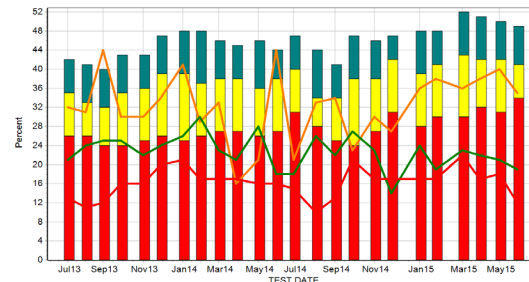


- How will you know if SDCT is successful?
- Data needed/recommended:
  - Consistent recording of clinical mastitis
  - DHIA SCC data
  - BTSCC and culture

# Monitoring



- #1 Dry period
  - Clinical mastitis in early dry period? → Problem with dry-off procedures
    - Must observe cows in dry pen!
  - Dry period infection dynamics (SCC)
    - New, Cure, Clean, Chronic
  - Dry period length – consistency

# Monitoring



- #2 Early lactation
  - Clinical mastitis in early lactation
    - Detect and record cases!
      - ID, date (DIM), severity, treatment
  - SCC (subclinical mastitis) - % cows with 1st test > 200,000
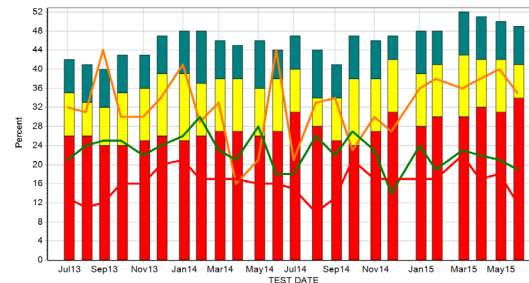
# Monitoring
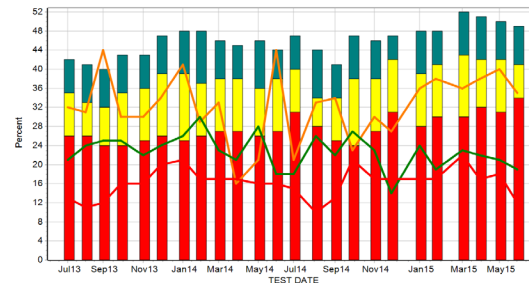


- #3 Herd level risk & contagious pathogens
  - BTSCC
  - Bulk milk culture to screen for contagious pathogens
  - Routine culturing of clinical mastitis throughout lactation

- Start now so you can assess the impact of SDCT!

# DairyComp305 SDCT Module

- Econ/SDCT
  - Cows grouped as high risk or low risk
  - Work with VAS and Vet of Record to set up parameters and assign dry off protocols for each group
  - Parameters:
    - DCC minimum threshold
    - SCC threshold
    - # SCC tests to consider
    - # of mastitis events
- Guide > SDCT for monitoring!
- For more info, VAS webinar:
  - https://vas.com/blog/2022/01/07/how-to-set-up-selective-dry-cow-therapy-with-dairycomp/

# Modified DHI-370 Flex Report

- Eligible herds:
  - 8+ DHI tests in last 12 months
  - Annual Herd Average SCC <250,000
  - <3 DHI herd tests over 250,000
- Eligible cows due to dry (green shaded):
  - SCC <200,000 at last test
  - Average SCC for last 3 tests <200,000

# MNDHIA Flex Report

| FLEX REPORT | 55-99-9999 | CPM-AR | Test Date: 09-02-2020 |
| --- | --- | --- | --- |
| DHI-370 | HENRY SMITH | | Processed: 09-04-2020 |
| Cows to Dry in Next 60 Days | | | |

| Test Type and Description | | Breed |
| --- | --- | --- |
| 31 | DHI-AP | HO |

Date To Dry uses Due Date and your herd's setting of Days in Dry Period = 45
Candidates for no dry cow antibiotics (Log SCC & Avg SCC/3 tests) < 4.0 AND
<u>0 or 1 case of clinical mastitis in the lactation (check your records)</u>

| Test Day Milk | | Actual SCC | | | % Tank | Cow | DryTrt (Y/N) | Date to Dry | DIM | Lact | Log SCC | Lact Avg | | #> 200K | #SCC Tests | Prod Index | Total Solids |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Actual | Exp | Last-3 | Prev | Curr | | | | | | | | Curr | Prev | | | | |
| 64 | 58 | 1600 | 1600 | 1493 | 2 | 1763 | | 09-20-20 | 285 | 1 | 6.9 | 6.4 | | 8 | 8 | 90 | 13.3 |
| 72 | 68 | 629 | 264 | 800 | 1 | 1586 | | 09-21-20 | 352 | 2 | 6.0 | 4.8 | 1.9 | 8 | 11 | 110 | 14.2 |
| 60 | 65 | 83 | 132 | 66 | | 1588 | | 09-30-20 | 364 | 2 | 2.4 | 2.8 | 0.5 | 3 | 11 | 110 | 15.0 |
| 70 | 74 | 78 | 47 | 174 | | 1693 | | 09-30-20 | 395 | 1 | 3.8 | 1.6 | | 1 | 11 | 117 | 13.8 |
| 70 | 90 | 46 | 54 | 23 | | 1694 | | 09-30-20 | 367 | 1 | 0.9 | 1.9 | | 1 | 11 | 128 | 12.9 |
| 70 | 64 | 58 | 31 | 100 | | 1574 | | 10-06-20 | 312 | 2 | 3.0 | 1.2 | 2.9 | | 10 | 97 | 14.7 |
| 72 | 67 | 281 | 283 | 123 | | 1470 | | 10-08-20 | 258 | 3 | 3.3 | 2.2 | 1.7 | 2 | 9 | 93 | 13.2 |
| 94 | 78 | 268 | 230 | 460 | 1 | 1491 | | 10-12-20 | 261 | 3 | 5.2 | 2.5 | 2.6 | 3 | 9 | 94 | 12.8 |
| 78 | 89 | 99 | 100 | 107 | | 1606 | | 10-12-20 | 268 | 2 | 3.1 | 1.8 | 1.7 | | 8 | 104 | 12.6 |
| 72 | 73 | 24 | 22 | 41 | | 1501 | | 10-15-20 | 286 | 3 | 1.7 | 0.5 | 2.0 | | 9 | 113 | 14.0 |

# Resources

- Nice overview of Partial Budget analysis by authors in Pro-Dairy: https://nyfvi.org/wp-content/uploads/2021/08/ProDairy.Cornell-JUNE2464_3pages.pdf

- UMN Extension SDCT educational materials https://extension.umn.edu/dairy-milking-cows/selective-dry-cow-therapy

- Moos Room Podcast (episode 36): z.umn.edu/themoosroomapple / z.umn.edu/themoosroomgoogle / z.umn.edu/themoosroomiheartradio

- AABP Have You Herd? Podcast – Selective Dry Cow Therapy https://www.buzzsprout.com/814177/10109266

# Questions?

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## Thank you!

# Selected References

- Rowe, S., M. Dziuba, B. Boyum, S. Godden, E. Royster, and L. Caixeta. 2022. Negatively Controlled Trial Investigating the Effect of Dry Cow Therapy on Clinical Mastitis and Culling. Proc. 61th Annual meeting of the National Mastitis Council:262-263.
- Rowe, S., S. Godden, D. Nydam, P. Gorden, A. Lago, A. Vasquez, E. Royster, J. Timmerman, and M. Thomas. 2020a. Randomized controlled non-inferiority trial investigating the effect of 2 selective dry-cow therapy protocols on antibiotic use at dry-off and dry period intramammary infection dynamics. J. Dairy Sci. 103(7):6473-6492.
- Rowe, S., S. Godden, D. Nydam, P. Gorden, A. Lago, A. Vasquez, E. Royster, J. Timmerman, and M. Thomas. 2020b. Randomized controlled trial investigating the effect of 2 selective dry-cow therapy protocols on udder health and performance in the subsequent lactation. J. Dairy Sci. 103(7):6493-6503.
- Rowe, S., S. Godden, D. V. Nydam, P. Gorden, A. Lago, A. Vasquez, E. Royster, J. Timmerman, and M. Thomas. 2020c. Evaluation of rapid culture, a predictive algorithm, esterase somatic cell count and lactate dehydrogenase to detect intramammary infection in quarters of dairy cows at dry-off. Prev. Vet. Med. 179:104982.
- Rowe, S., S. Godden, E. Royster, J. Timmerman, and M. Boyle. 2021a. Postcalving udder health and productivity in cows approaching dry-off with intramammary infections caused by non-aureus Staphylococcus, Aerococcus, Enterococcus, Lactococcus, and Streptococcus species. J. Dairy. Sci. 104(5):6061-6079.
- Rowe, S., D. Nydam, S. Godden, P. Gorden, A. Lago, A. Vasquez, E. Royster, J. Timmerman, M. Thomas, and R. Lynch. 2021b. Partial budget analysis of culture-and algorithm-guided selective dry cow therapy. J. Dairy. Sci. 104(5):5652-5664.
- Rowe, S. M., A. K. Vasquez, S. M. Godden, D. V. Nydam, E. Royster, J. Timmerman, and M. Boyle. 2021c. Evaluation of 4 predictive algorithms for intramammary infection status in late-lactation cows. J. Dairy. Sci. 104(10):11035-11046.

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