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Reduction or Elimination of Mycoplasma Mastitis in Utah Dairy Herds Following the Statewide Surveillance Project, and a Comparison of Strategies Against Mycoplasma

This report was written with the help of Anne Justice-Allen DVM, MS, my recently graduated MS student, and our Epidemiology Technician Jennifer Maddox. It describes progress made against mycoplasma mastitis in Utah since our statewide surveillance project in 2007. References are available upon request.

Our 2007 survey of Utah dairy herds was designed to determine herd-level prevalence of *Mycoplasma* spp. mastitis; those results were reported in this newsletter, a journal paper, and at several presentations including in Utah. Of the 285 dairy farms then in Utah, 222 (78%) participated in that study. Milk haulers or dairy producers collected 5 milk samples from all bulk tanks on participating farms at 3-4 day intervals (97% sensitivity and 100% specificity for detection of mycoplasma in milk). Milk was frozen at -20^0 C and shipped frozen overnight to the laboratory for detection of *Mycoplasma* spp. Mycoplasma culture was performed using NMC accepted methods. That previous study found 16/222 Utah dairy farms (7%) positive for *Mycoplasma* spp. in bulk tank milk. 12 farms participated fully in a first follow up interview and farm visit. Objectives of the study reported here were to evaluate progress in control of *Mycoplasma* spp. mastitis in those Utah dairy herds diagnosed approximately one year earlier, and to compare management practices used on mycoplasma-positive dairy farms during the year following diagnosis.

Materials and methods

At the first follow up visit, the 12 producers were told that a second visit would be offered in approximately one year. Specific recommendations for each farm were made at the first follow up visit after a discussion with producers. However, recommendations always included that individual cows' milk be cultured for *Mycoplasma* spp., whether by sampling the entire lactating herd at one time and/or culturing milk from cows at the onset of clinical mastitis (**CM**) and also following calving, for at least one year. It was always also recommended that all mycoplasma-positive cows be culled as soon as possible after diagnosis. Other recommendations sometimes included changes in milking or mastitis treatment practices, e.g. use of individual towels for each cow at milking time instead of common use towels for more than one cow, or recording all treatments for CM if this was not already being done.

It was explained to participating producers at the beginning of the surveillance project that because of budget and logistics, there would be no further diagnostic testing conducted or paid for by Utah State University. All follow up mycoplasma diagnostic testing performed, and any management changes made on the mycoplasma-positive farms during the subsequent year were strictly those implemented by the farm owners. Therefore this study was not a planned experiment, but was a field observational study. After one year, the participating producers were contacted and offered the second follow up survey during 2008 to discuss any changes in their dairy herds as well as questions they might have, and to attempt to learn some new information from them to benefit the dairy industry. The survey used a different questionnaire than that for the initial visits; both were designed at Utah State University.

Mycoplasma diagnostic test results the dairy producers obtained over the previous year were from cultures performed at one of two diagnostic laboratories, chosen by the farm owners, using NMC methods. Detection of CM was according to each farm's established practices. These were similar on all of the farms, primarily by detection of abnormal milk and/or swelling of at least one quarter of the mammary gland.

Definitions of herd mycoplasma status

Mycoplasma status of dairy herds at the time of the second follow up survey was defined as: Free - individual cow milk cultures and/or bulk tank milk cultures being performed and no mycoplasma detected in any milk samples during the previous 3 mo. Continued Positive - individual cow milk cultures and/or bulk tank milk cultures detected mycoplasma in at least one milk sample during the previous 3 mo. Unknown – No individual cow milk or bulk tank milk diagnostic testing performed during the previous 3 mo.

Results

10 of the 12 farms that participated in the first follow up survey participated in the second follow up survey reported here. Characteristics of the 10 farms approximately one year after mycoplasma was detected by the surveillance project are shown in Table 1.

Mycoplasma bulk tank monitoring

Culture of bulk tank milk was utilized by 7 producers (70%) after mycoplasma was first found by the project (Table 1). Mycoplasma bulk tank testing was still being done monthly on 4 farms, every 2 mo on one farm, had last been done 3 mo earlier on one farm and 6 mo earlier on another farm. The other 3 farms (30%) had not cultured any bulk tank milk samples after they were informed that mycoplasma was found in bulk tank milk (Table 1).

Individual cow testing for mycoplasma

8 farms (80%) had cultured milk of individual cows for *Mycoplasma* spp.; 6 (75%) of those farms had also monitored bulk tank milk (Table 1). 5 farms (50% of total) cultured milk from all cases of CM; 4 of those 5 farms also cultured milk from cows after calving, as soon as milk did not appear colostral, and were continuing to culture both post-calving and mastitic cows' milk for mycoplasma after approximately one year (Table 1). Farm A also cultured milk for mycoplasma from cows with individual cow monthly DHIA SCC > 500,000/ml. Farm C had initially cultured CM cases and then stopped after they had sold all mycoplasma-positive cows and found no more; thus after one year they were utilizing bulk tank milk culture only to monitor for mycoplasma (Table 1). 3 other farms had cultured milk of all lactating cows for mycoplasma at one milking, approximately 1 mo after mycoplasma was detected by the project (Table 1). Culture of milk of individual cows for mycoplasma was never utilized on 2 farms (20%), one of which used bulk tank milk monitoring (farm H, Table 1).

One farm reported that they had done no diagnostic follow up testing of any kind for mycoplasma. The owners had not tested for mycoplasma before the surveillance project, and thus did not know that mycoplasma mastitis affected their herd previously. The producer stated that he had suspected mycoplasma in the herd, and was now culling chronically mastitic cows sooner; he perceived benefit from the diagnosis of mycoplasma in the herd.

Mycoplasma status of herds after one year was evaluated. 3 farms (30%) were Free – no further evidence of mycoplasma mastitis during the previous 3 mo (Table 1). 2 of the Free farms had found no mycoplasma while continuing to culture milk from all CM cases and fresh cows during the previous 3 mo, having sold all mycoplasma-positive cows found earlier during the year (farms A and B, Table 1). The remaining Free farm (C, Table 1) had sold all cows that were detected with mycoplasma as described above, and had subsequently found no positive bulk tank milk cultures (6 negative cultures for mycoplasma, 2 from each of the 3 bulk tanks on the farm) during the previous 3 mo.

4 farms (40%) had Continued Positive mycoplasma – continuing evidence that mycoplasma mastitis was still present during the previous 3 mo (Table 1). 2 farms had found mycoplasma-positive cows (E, one cow in the 5,200-cow herd, F, "several" cows in the 1,015-cow herd, Table 1) during the previous 3 mo. Farm D had cultured the entire lactating herd (381 cows) for mycoplasma 11 mo earlier, approximately one mo after the surveillance project detected the disease, and had not sold all positive cows by the second survey. Farm G (500 cows) had a mycoplasma-positive bulk tank culture result during the previous 3 mo.

3 farms (30%) were of Unknown mycoplasma status (Table 1). Farm H had monthly bulk tank cultures for mycoplasma performed but were not sure of the results, and had never tested individual cows for mycoplasma. Farm I had cultured the entire lactating herd (650 cows) for mycoplasma 11 mo earlier, approximately 1 mo after the surveillance project detected the disease, sold all 14 positive cows detected, and had done no further mycoplasma testing for the remainder of the year. Farm J had done no diagnostic follow up testing of any kind for mycoplasma, as described earlier.

Table 1. Dairy herd characteristics one year after detection of mycoplasma mastitis.

Farm	Mycoplasma status[a]	Bulk tank cultures	Mycoplasma cow cultures	Herd size
A	Free	3 mo ago	CM[b], fresh[c], SCC>500 K DHIA[d]	807 cows
B	Free	6 mo ago	CM, fresh	1,900
C	Free	Every 2 mo	CM until no more found[e]	2,100
D	Continued Positive	None	Entire herd at once, 11 mo ago	381
E	Continued Positive	Monthly	CM, fresh	5,200
F	Continued Positive	Monthly	CM, fresh	1,015
G	Continued Positive	Monthly	Entire herd at once, 11 mo ago	500
H	Unknown	Monthly[f]	None	NA[g]
I	Unknown	None	Entire herd at once, 11 mo ago	650
J	Unknown	None	None	300

[a] Mycoplasma status = Whether herd had ongoing mycoplasma diagnostic testing with no further mycoplasma mastitis found (Free), continuing evidence that mycoplasma mastitis was still present (Continued Positive), or unknown mycoplasma status (Unknown) during the previous 3 mo

[b] CM = Milk from all clinical mastitis cases being cultured for mycoplasma until time of second follow up

[c] fresh = Milk from all cows post-calving being cultured for mycoplasma until time of second follow up

[d] SCC>500 K DHIA = Milk from all cows with SCC>500,000/ml on most recent monthly DHIA herd test being cultured for mycoplasma until time of second follow up

[e] CM until no more found = Milk from all clinical mastitis cases on farm C was cultured for mycoplasma until no more were found for several mo, then stopped. All cows found positive had been sold.
[f] Were not sure of recent monthly bulk tank mycoplasma culture results
[g] NA = Not available

Lactating Herd Sizes

All 9 farms responding about cow numbers had increased their dairy herd size during the previous year. Lactating cow numbers in the study herds are shown in Table 1. All milked ≥ 300 cows, 5 milked > 800 cows and 3 milked ≥ 1,900 cows. The 3 farms with Free mycoplasma status all milked more than 800 cows (Table 1).

SCC in Bulk Tank Milk

Bulk tank SCC (**BTSCC**) data (mean for the most recent mo) was available from either milk buyer history forms or DHIA, shown in Table 2. Whether BTSCC had increased, decreased, and the farms' mycoplasma status are also shown. The BTSCC had decreased on 6 farms (60%), including 2 mycoplasma Free, 3 Continued Positive and 1 Unknown farm. The BTSCC had increased on 3 farms (30%), including 1 Free, 1 Continued Positive, and 1 Unknown farm. One farm's SCC remained at 270,000/ml as it had been the year before. The SCC for 3 (30%) of the farms was between 120,000 and 132,000/ml, all decreased. Eight (80%) of the farms had BTSCC ≤ 240,000/ml. The highest herd SCC averaged 303,000/ml; SCC had increased and there was Continued Positive mycoplasma mastitis in that herd.

Milk Production

For 9 farms, actual milk production per 305 d from monthly data of total milk shipped and total lactating cow numbers was available, shown in Table 2. Whether milk production had increased, decreased, and the farms' mycoplasma status are also shown. Milk production had increased over the previous year on 6 farms (67%), and decreased on the other 3 farms. All herds averaged at least 18,600 lb (8,444 kg)/cow/305 d, and 5 (55%) averaged between 21,900 lb (9,943 kg) and 24,400 lb (11,078 kg) per 305 d. The highest producing herd averaged 24,400 lb (11,078 kg), increased from the previous year, and mycoplasma was no longer detected in the herd (Table 2).

Table 2. Dairy herd bulk tank milk SCC and milk production one year after detection of mycoplasma mastitis.

Farm	Mycoplasma status[a]	BTSCC/ml[b]	BTSCC change[c]	Production[d]	Prod change[e]
A	Free	220,000	Decrease	24,400 lb (11,078 kg)	Increase
B	Free	220,000	Increase	19,600 lb (8,898 kg)	Decrease
C	Free	130,000	Decrease	20,300 lb (9,216 kg)	Increase
D	Continued Positive	303,000	Increase	24,000 lb (10,896 kg)	Increase
E	Continued Positive	120,000	Decrease	24,200 lb (10,987 kg)	Increase
F	Continued Positive	180,000	Decrease	18,600 lb (8,444 kg)	Decrease
G	Continued Positive	240,000	Decrease	21,900 lb (9,943 kg)	Increase
H	Unknown	180,000	Increase	NA[f]	NA
I	Unknown	270,000	Unchanged	23,200 (10,533 kg)	Increase
J	Unknown	132,000	Decrease	20,600 (9,352 kg)	Decrease

[a] Mycoplasma status = Whether herd had ongoing diagnostic testing with no further mycoplasma mastitis found (Free), continuing evidence that mycoplasma mastitis was still present (Continued Positive), or unknown mycoplasma status (Unknown) during the previous 3 mo
[b] BTSCC/ml = Bulk tank milk SCC
[c] BTSCC change = Direction of change in BTSCC since mycoplasma was detected approximately one year earlier

[d] Production = actual milk production per cow per 305 d from monthly data of total milk shipped and total lactating cow numbers
[e] Prod change = Direction of change in milk production since mycoplasma was detected approximately one year earlier
[f] NA = Not available

Disposition of mycoplasma-positive cows
5 (71%) of the 7 producers who had detected some cows culture-positive for mycoplasma had sold all positive cows during the previous year. (The other 2 had sold most of their positive cows.) The 5 farms that sold all known positive cows included 2 mycoplasma Free farms (B, C), 2 Continued Positive farms (E, G) and an Unknown farm (I). By definition, the 2 farms that had not sold all known positive cows had Continued Positive mycoplasma (D, F).

Milking practices for mycoplasma-positive cows
4 (57%) of the 7 producers that had found individual cows with mycoplasma milked all positive cows last, including 3 Continued Positive farms and 1 Free farm (mycoplasma-positive cows had been milked last when still present). These practices were similar to those found one year earlier.

Calving areas for mycoplasma-positive cows
There were 5 farms that had both detected and kept some mycoplasma-positive cows (2 did not sell them all, 3 kept some for awhile before selling all). 2 of those 5 farms (40%) had mycoplasmal cows calve in the same calving area as all other cows - both farms had Continued Positive mycoplasma in their herds (D, F). On the other 3 farms all mycoplasma-positive cows were sold before they could calve again. The latter farms included 2 with Continued Positive (E, G) and one with Free mycoplasma status (B).

Clinical mastitis treatment and monthly rates
The number of different people on the farm that treated CM in one mo was as follows: one person – 1 farm, two people – 5 farms, three people – 2 farms, four people – 2 farms. 8 of the farms recorded CM cases. Clinical mastitis cases/mo had decreased on 3 of the 8 farms (38%). The decrease in CM cases/mo, the lactating herd size, and current mycoplasma status for the 3 herds were as follows: 19 fewer cases/1,900 cows (1.0% of herd decrease/mo) – farm B, mycoplasma Free; 15 fewer cases/2,100 cows (0.7% of herd decrease/mo) – farm C, mycoplasma Free; 39 fewer cases/5,200 lactating cows (0.8% of herd decrease/mo) – farm E, Continued Positive, but only 1 mycoplasmal cow found in previous 3 mo.

Clinical signs in cows and calves
At the first follow up visit, cows with droopy ears and pre-weaned calves with respiratory disease nonresponsive to treatment were reported on all but one mycoplasma-positive farm. At the time of the second follow up reported here, 3 producers (30%) had no longer seen droopy ears of adult cows or nonresponsive calf respiratory disease during the previous 3 mo; these were the owners of all 3 mycoplasma Free farms. All other farms still observed either adult cows with droopy ears, calves with nonresponsive respiratory disease, or both, and all of them had either Continued Positive or Unknown mycoplasma in their herds.

Clinical mastitis moving from one quarter to another had been observed on 75% of mycoplasma-positive farms shortly after mycoplasma was detected by the project. At the second follow up, 5 producers (50%) no longer reported CM moving between quarters during the previous 3 mo, including 2 with mycoplasma Free herds (B, C), 2 of Unknown status (H, I), and one Continued Positive for mycoplasma (G). The other

mycoplasma Free farm (A) had only observed CM moving between quarters in 1 cow; she was culture-negative for *Mycoplasma* spp. and was sold. The remaining 4 producers who still reported CM moving from quarter to quarter during the previous 3 mo included owners of 3 Continued Positive mycoplasma farms (D, E, F) and one of Unknown status (J).

Changes in management practices following diagnosis of mycoplasmal mastitis
Milking and treatment practices in place when mycoplasma was first detected included: Common (used on more than one cow) cloth towels were used on 50% of mycoplasmal farms, common paper towel drying on 8%, and individual cow cloth towel drying on 42%.

At the time of the second follow up reported here, 3 producers (30%) had made the following changes:
Farm C (mycoplasma Free) – Instead of common paper towel for several cows, changed to cloth towels, 2 cows/towel, machine washed but not dried in dryer (towels were damp to touch when used to dry teats before milking).
Farm D (Continued Positive) – Isolation of high SCC cows and suspected mycoplasma cows (based on clinical observations only) together with the cows cultured positive for *Staphylococcus aureus* in one pen.
Farm E (Continued Positive) – Just began using cephapirin instead of pirlimycin or ceftiofur as standard CM treatment.

Producers' opinions regarding the most important mycoplasma control measures
7 (70%) of producers responded regarding what they considered the most important mycoplasma control practices. 2 with mycoplasma Free farms answered:
-Pasteurize calf milk, segregate calves with respiratory disease, install ventilation fans in post-weaned calf barns, culture individual cows' milk for mycoplasma and cull positive cows.
-Keep cows clean, milk high SCC cows last.
Owners of Continued Positive or Unknown status herds answered more generally, such as reduce stress and milk smaller herds.

Dairy cattle breeds milked
Dairy breeds milked in the 10 herds were: Holsteins (100%), Jerseys (70%), Brown Swiss (40%), Swedish Red (20%), Ayshire (10%), Guernsey (10%), "Angus crossbreds" (10%). Three farms milked only Holsteins; all 7 other farms milked both Holsteins and Jerseys, and some milked one or more other breeds listed above.

Discussion

Most producers with mycoplasma-positive herds decided to culture milk from individual cows for mycoplasma after the bulk tank surveillance project detected the disease, but none used both culture of the entire lactating herd at one milking and culturing milk from CM cases and post-calving cows for mycoplasma, all chose one individual cow testing strategy or the other. Only one producer elected to do no further mycoplasmal diagnostic testing after the surveillance project detected mycoplasma in their herd; they used the information to increase culling of chronically mastitic cows.

In this study, milk culture from cows with clinical mastitis and after calving was associated with likelihood of farms becoming free of detectable mycoplasma, but bulk tank culture monitoring and/or culture of the entire lactating herd all at one time was not. Farms culturing milk from all CM cases for mycoplasma either apparently eliminated the disease, or achieved a low prevalence of known mycoplasma-positive cows

remaining. Of farms that had used only bulk tank monitoring with or without whole-herd culture for mycoplasma, all were still mycoplasma-positive or of unknown status after 1 year.

Whether mycoplasma mastitis remained in the herds or not, the Utah dairy herds detected with mycoplasma in milk a year earlier remained large, and all had increased in herd size. Most milked between 800 and >1,900 cows, with relatively high milk production – most averaged between approximately 22,000 – 24,400 lb (9988 – 11,078 kg) per lactation. The BTSCC was relatively low, with most herds between 120,000 and 240,000/ml, similar to levels the year before when mycoplasma was initially detected. There was no apparent overall relationship between SCC, milk production, whether those parameters increased or decreased during the past year, and whether or not mycoplasma mastitis continued to be detected in the herds. This has been reported before; financial loss from mycoplasma is mainly caused by death or culling of affected cows. Herd mean BTSCC may increase and mean milk production may decrease during outbreaks of disease attributable to infection with *Mycoplasma* spp., but often there is not marked change, exactly as did not occur in these studies in Utah. Thus the most effective surveillance for *Mycoplasma* spp. utilizes testing of milk samples from individual cows and/or bulk tank milk over time, rather than monitoring herd mean milk production or BTSCC.

It has often been found that presenting signs of mycoplasma disease in dairy herds include respiratory tract disease in cows or calves, lameness and CM moving from one quarter to another. All of the farms in this Utah study that became apparently free of mycoplasma mastitis after one year no longer reported nonresponsive respiratory disease in calves or droopy ears of cows, having reported it when mycoplasma was first detected. Non-responsive respiratory disease is not considered pathognomonic for mycoplasmosis in calves, and mycoplasma in calves is reported to be present on nearly all dairy farms while mycoplasma in milk of cows is not, so it was unexpected that descriptions of calf respiratory disease would be associated with mycoplasma in adult cows. Nevertheless, this sign was indeed associated with whether or not mycoplasma continued to be found in lactating cows in this study. It has been reported that CM moving from one quarter to another is an important indicator of the likelihood of mycoplasma mastitis but in addition, the disappearance of this sign may suggest that mycoplasma infections of the mammary gland are absent or at very low levels in a previously positive herd. These associated clinical signs require further investigation, but could be useful supplementary monitoring tools for mycoplasma mastitis over time.

When producers stated what they considered to be the most important mycoplasma control practices, the most specific answers came from producers that no longer had mycoplasma detected. Producers with specific plans may be more likely to make management changes, including those associated with subsequent reduction of an infectious disease in their herds.

Decreased or eliminated mycoplasma mastitis in herds was associated with approximately 1% less of the herd per mo contracting CM than they were a year earlier.

Conclusions

Culture of milk from cows after calving and from cows contracting clinical mastitis, and culling all mycoplasma-positive cows appeared more effective than bulk tank culture monitoring or individual-cow milk cultures of the entire lactating herd at one time for eliminating mycoplasma mastitis from dairy herds. Farms that had previously been diagnosed with mycoplasma mastitis but presently tested free of it were not likely to observe clinical mastitis moving from one quarter to another, droopy ears in adult cows, or nonresponsive respiratory disease in calves; most farms reported those signs when mycoplasma mastitis was previously diagnosed and if it continued to be detected. An important benefit of reducing or eliminating mycoplasma mastitis from dairy herds was an associated reduction in the rate of clinical mastitis.

Acknowledgments

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It is always good to hear from our readers, including suggestions for future topics. I can be reached at (435) 760-3731 (Cell), (435) 797-1899 M-W, (435) 797-7120 Th-F or David.Wilson@usu.edu.

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