A Two-Year Survey of Five Herds with High Wisconsin Mastitis Test Scores

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A field trial was conducted in five dairy herds whose average monthly Wisconsin Mastitis Test (WMT) scores averaged 16 mm or higher in the 6 month period prior to beginning the trial. Mastitis control practices, predominantly the use of postmilking teat dipping (TD) with non-irritating germicides, and the use of intramammary antibiotic infusion at the beginning of the nonlactating (DT) period, have been acknowledged to be effective for controlling intramammary infections for more than 10 years. Effective control, based on data from large field trials, is expected to reduce the percent of infected cows in a herd to less than 15%. Reducing and maintaining infection at this level or lower will result in a bulk tank cell count of less than 500,000 cells per ml and a WMT score of 12 mm or less.

The question which may be asked regarding herds with continued high WMT scores is whether they have or have not adopted a TD+DT program. If it is determined that a herd is using the program, then the next question asked is why the program is not producing the desired results. Some reasons for failure of a herd to respond have been reported. These include dirty environment, purchased additions of cows and failure to use the practices regularly.[1] Undoubtedly, there are other reasons why some herds do not respond. We identified five herds in the Central Ohio area with high WMT scores to study these questions.

The first objective was to measure the effectiveness of mastitis control practices in herds with high WMT scores.

The second objective was to measure the effectiveness of 400 mg of novobiocin when used as the nonlactating period infusion component of the program, when novobiocin-penicillin was routinely used for intramammary infusion of infected lactating glands.

A third objective, in the event a herd did not respond, was to attempt to learn the reason or reasons for this failure.

Materials and Methods

Six herd owners were identified by a local milk marketing cooperative as herds with high WMT scores. Owners were contacted and asked to participate in the trial. Five herd owners consented to participate.

The authors visited the herds at the beginning of the trial for the purpose of evaluating practices used on the farm. The cleanliness of the environment was subjectively appraised. Milking technique, methods and times were observed and recorded. Milking machine function was evaluated. Composite milk samples were collected from lactating cows for bacteriological culture to establish the prevalence of infection with the four Gram positive cocci: *Staphylococcus aureus, Streptococcus agalactiae, Streptococcus dysgalactiae* and *Streptococcus uberis,* which cause the majority of infections. Samples were collected and cultured according to described methods.[2,3]

When deficiencies were noted in regard to milking technique, machine function or maintenance of acceptable environment, recommendations were given to correct these.

Milking technique and machine function recommendations were based on published guidelines.[4,5] All herds used 400 mg novobiocin for dry treatment during the study and novobiocin-penicillin for intramammary therapy of clinical cases of mastitis in lactating cows.

During the first year of the trial, all herds were visited every three months to determine acceptance of the recommendations by the operators. At the end of the first and second years, herds were visited to re-evaluate the herds and to determine infection prevalence. The trial was begun in November 1977, and concluded in November 1979.

Herd No. 1

This herd consisted of 34 grade Holsteins and was managed by the owner. The herd was housed in loose housing using straw for bedding and limited summer pasture. Cows were kept very clean. Milking was done in a double three-herringbone parlor with three units and weigh jars. This herd had been using the TD+DT program since 1970. It was enrolled in a dairy herd improvement (DHI) owner-sampler production testing program.

At the time of the first visit, we noted a vacuum level of 14″

Hg and recommended that it be lowered to 12.5" Hg, which was done in May 1978. Observation of milking technique revealed that cows were not milked out completely. Milking times averaged 2.5 minutes. The owner felt that overmilking would cause clinical mastitis and was reluctant to change this practice. On the last visit, the cows were milked out by hand, by the authors, after removal of the milking machine. Three to five pounds of milk were found to be left in the udder after machine removal. Because of continued high cell count problems (Table 1) and persistently high infection prevalence (Table 1), the owner was persuaded to lengthen milking times. A timer alarm was used in the parlor and set at four minutes prior to attaching the units. No milkers were to be removed before four minutes. The owner agreed to this as an attempt to retrain himself. WMT scores declined and production increased in the six months following adoption of longer milking times.

It appeared that the limiting factor in this herd may have been undermilking, which can directly inhibit production and perhaps increase infection. Previous reports have indicated that undermilking increases the severity of existing infections.[6]

Table 1.
Herd No. 1
Infection Prevalence
Staphylococcus aureus, Streptococcus agalactiae (Sag), Streptococcus dysgalactiae and *Streptococcus uberis*

Date	Infected/Cultured	Prevalence	Note
11/77	13/28	46.4%	No Sag
11/78	11/32	34.3%	No Sag
11/79	10/23	43.5%	No Sag

WMT Scores
Average of (n) tests prior to herd visits

Date	(n) Tests	mm
11/77	5	19.2
11/78	5	16.8
11/79	5	19.3
5/80	3	14.3

Production DHI - OS

Date	Cows	Herd Average Milk (lb)	Fat (lb)
11/77	46.7	10,081	346
11/78	43.3	12,658	448
11/79	43.2	12,546	435
5/80	38.5	13,758	442

Herd No. 2

This herd consisted of 80 grade Holsteins operated by the owners: a man, two sons and one employee. The herd was housed in a stanchion barn using straw bedding and summer pasture. The cows were milked with four units into a high line. One man did the milking with some assistance for teat dipping. TD+DT was begun in September 1977 in this herd, in anticipation of its involvement in the project. No production testing program was used which severely limited the value and use of production data.

Cows in this herd were kept in stanchions. Udders of some cows were not clean, and management of bedding did not improve during the trial. Observation of milking technique revealed that teats were not properly cleaned prior to machine attachment. During the first year, this was improved; but at the end of two years, preparation was done much as it had been done prior to the trial. In this stanchion barn, the operation of four units by one man left little time for detailed work as the 80 cows wer milked in slightly less than two hours.

Milking machine function was determined to be inadequate because of lack of maintenance. Slope of the milk line was inadequate at some points. Reserve air flow was nonexistent and vacuum levels were not in balance. These problems were corrected prior to the February 1978 visit.

At the end of two years it was apparent that in spite of marginally acceptable practices for maintaining clean udders and for preparing udders for milking, the infection prevalence in the herd was responding to the TD=DT program. The owners felt the program was successful in spite of continued high WMT scores (Table 2), because fewer clinical cases of mastitis were seen.

The failure of the WMT score to fall may have been related to the duration of the trial with insufficient time allowed to see a reduction. Other possible reasons for continued high WMT scores were not evident from information collected in this study.

Herd No. 3

This herd consisted of 36 grade Holsteins owned and operated by a father and son, respectively. The herd was housed in a free-stall barn with sawdust used for bedding. Cows were pastured for limited periods in the summer. Repair and daily maintenance of the free-stall barn was less than adequate and cows were frequently not clean. Cows were milked through a double four-herringbone parlor using a low line and four units. This herd had been using TD+DT intermittently for several years. This herd was on DHI test at the beginning of the project. They discontinued testing for some time during the trial, and then resumed DHI unofficial testing (DHI-AM-PM) later.

At the beginning of the trial the operator was advised of the necessity to keep the cows clean. During the two year period of the trial, new free-stalls were added, but daily

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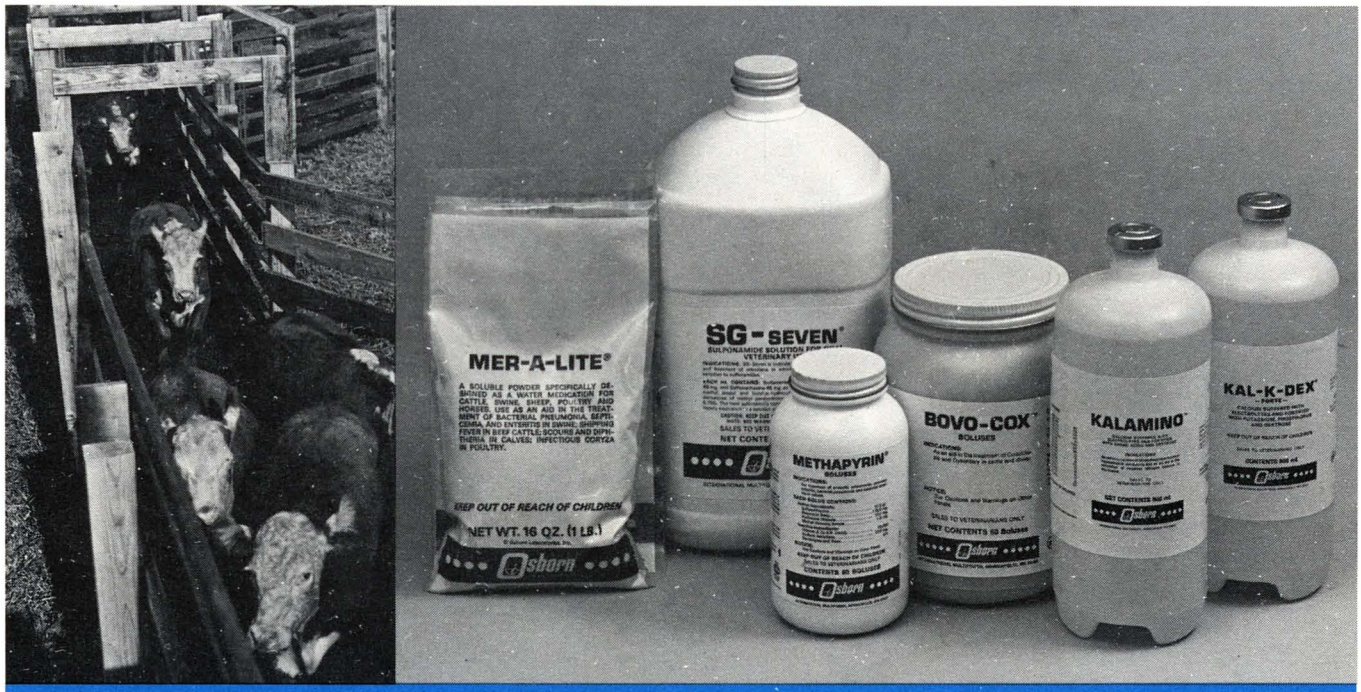

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Table 2.
Herd No. 2
Infection Prevalence
Staphylococcus aureus, Streptococcus agalactiae (Sag), Streptococcus dysgalactiae and *Streptococcus uberis*

Date	Infected/Cultured	Prevalence	Note
11/77	31/69	44.9%	18.8% Sag
11/78	22/81	27.1%	No Sag
11/79	10/72	13.9%	No Sag

WMT Scores
Average of (n) tests prior to herd visits

Date	(n) Tests	mm
11/77	6	21.3
11/78	5	17.6
11/79	5	21.3
5/80	5	19.9

Production
Average daily per cow production for 20 days preceding visits

Date	lb/cow/day
11/77	33
11/78	53
11/79	39

Table 3.
Herd No. 3
Infection Prevalence
Staphylococcus aureus, Streptococcus agalactiae (Sag), Streptococcus dysgalactiae and *Streptococcus uberis*

Date	Infected/Cultured	Prevalence	Note
1977	15/43	34.8%	No Sag
1978	9/34	26.4%	11/7% Sag
1979	15/47	31.9%	No Sag

WMT Scores
Average of (n) tests prior to herd visit

Date	(n) Tests	mm
11/77	5	21.1
11/78	5	21.0
11/79	6	19.0
5/80	4	15.5

Production

Date	Cows	Herd Average Milk (lb)	Herd Average Fat (lb)
10/77	46.6	14,391	504
11/78	34.2	13,854	486
11/79	44.5	11,285	425
3/80	48.6	11,136	423

maintenance of stalls did not improve and the condition of the udders continued to be less than satisfactory.

Four components or parameters of machine function were noted as needing improvement. Regulators were mounted on pipes that were not securely fastened. They vibrated and created a potential for unstable vacuum. This problem was corrected before February 1978. The long milk hoses were excessively long, looping to pit floor level before rising to meet the milk inlet. This was also corrected before February 1978. The capacity of the claw used in this system was less than 150 cc. Undocumented recommendations have indicated that the claw capacity should exceed 300 cc to aid in reducing cyclic vacuum fluctuations. The pulsator ratio was 65:35 and recommendations were made to slow the ratio to between 60:40 and 50:50. These last two recommended changes were not made.

At the end of the first year, cultures revealed the herd to have become re-infected with *Streptococcus agalactiae* (Table 3). Possible reasons for this are that the owner did purchase two cows. It is also possible that the organism was present in the cows that were dry and not cultured in 1977 or in heifers. At the end of the first and second year, the operator reported intermittent use of teat dip during the cold winter months.

Failure of this herd to experience a reduction in infection prevalence and to reduce WMT scores can be tentatively explained by the environmental conditions, purchased herd additions, and intermittent use of teat dip. Declining production may partially be due to changing forage quality and failure to utilize any type of ration evaluation program.

Herd No 4

This herd consisted of 45 grade Guernseys owned by a father and operated by his son. A few Holsteins were added to the herd during the study. The herd was housed in loose housing with straw bedding and in an exercise lot in summer. Cows were kept clean. Milking was done in a ten stanchion parlor using five units on a high line.

This herd had begun using TD six months earlier and had been using 100,000 units of penicillin for DT for the same

period. The herd was enrolled in DHI production testing.

At the time of the first visit, we noted that deficiencies in the milking system and recommended several changes. We recommended that only eight stanchions and four milker units be used. This was done before February 1978. We also advised to increase claw size, reserve air flow and pipeline size, and to decrease the vacuum level and slow the pulsation ratio. These changes were not made until one year later; a new system was installed in December 1978. This system was a brisket high, 2" line with four units. All parameters of function were within recommended limits.

Milking technique was observed to be inadequate. Preparation was inadequate, with preparation-to-attachment times of up to 2 minutes and 40 seconds. Teat dip was only applied to the teat end. With the discontinued use of one unit, preparation was improved and preparation-to-attachment time was shortened. Dip was subsequently applied to the entire teat surface.

Johne's disease was diagnosed by fecal culture in this herd in the fall of 1979.

Infection prevalence increased, which may have been related to the introduction of new cows, although this was unclear. The herd experienced continued high cell counts and an outbreak of staphylococcal mastitis in March 1979 (Table 4). The net effect of changing machine function should have resulted in slower milking. Our observations indicated that milking times (machine on time) did not change, which resulted in incomplete milkout. This may have contributed to the problem. Purchased cows may have introduced new organisms into the herd which may have precipitated the outbreak.

The presence of Johne's disease in this herd may also have been partly responsible for the continuing problem in herd four[7]

Another problem possibly related to delayed response in this herd was a long calving interval which delayed dry cow treatment. In this herd, calving interval was 17 months.

Production increased somewhat, in spite of infection problems, but was probably related to the addition of Holstein cows.

In March 1978, we were informed that the somatic cell count in herd No. 4 was in excess of 1,500,000 cells/ml. We re-evaluated the herd at that time. Nineteen of 32 cows were infected. Fourteen cows were infected with alpha-beta hemolytic, coagulase positive staphylococci. Some animals were culled from the herd, some were turned dry and dry treated, and ten of those infected with double zone hemolytic, coagulase positive staphylococci were treated with novobiocin-penicillin antibiotic infusion. At reculture 28 days later, of those lactating cows previously infected with staphylococci and treated, all were still infected with coagulase positive staphylococci although the hemolytic pattern had changed. Five were alpha hemolytic and five were beta hemolytic while one was an alpha-beta hemolytic organism. This probably indicated a failure of treatment. It could also have been due to other factors, but is similar to previous reports of poor response to intramammary treatment of staphylococcal infection in spite of selection of treatment based on *in vitro* susceptibility testing.[8]

Table 4.
Herd No. 4
Infection Prevalence
Staphylococcus aureus, Streptococcus agalactiae (Sag), Streptococcus dysgalactiae and *Streptococcus uberis*

Date	Infected/Cultured	Prevalence	Note
1977	19/33	57.5%	36.3% Sag
1978	13/32	34.3%	9.3% Sag
1979	15/24	62.5%	0

WMT Scores
Average of (n) tests prior to herd visit

Date	(n) Tests	mm
11/77	6	25.5
11/78	4	25.0
11/79	5	22.2
4/80	4	25.8

Production

Date	Cows	Herd Average Milk (lb)	Herd Average Fat (lb)
11/77	46.9	7,819	348
11/78	38.8	8,430	415
11/79	33.2	8,777	425
3/80	29.1	9,014	428

Herd No. 5

This herd consisted of 56 registered Holstein cows owned and operated by a wife and husband. The herd was housed in a free-stall barn with sawdust for bedding. Limited summer pasture was used. Cows were very clean. Milking was done in a 12-stanchion parlor with three units into a high line.

Teat dipping had been done sporadically for several months prior to the start of the project. Dry treatment consisted of 100,000 units of penicillin and had been done for several years. The herd was on DHI test.

Several items were recommended to be changed in the milking system including increased reserve air flow,

lowering and balancing vacuum, and eliminating dead end lines. All of these corrections were made December 1977. The owner preferred to use wide bore liners and persisted in using these in spite of advice to use narrow bore liners.

Milking technique was improved by beginning the use of individual paper towels and proper cleaning of teats prior to machine attachment. Preparation-to-attachment times were shortened.

In this herd, the response was toward reduced infection prevalence, slightly lower WMT and increased production. There have been no herd additions; they have continuously used TD+DT and the cows were kept clean.

Wide bore liners were used and there is some speculation that this could contribute to the continued high WMT score. The culling percentage in this herd is consistently lower than Ohio averages and this may also be a problem. Average culling is about 33% per year in Ohio dairies. In this herd, culling is lower than expected. Average age for DHI dairies in Ohio is four years and four months at last calving, and in herd five, five years and ten months.

Since older cows are known to be more susceptible to infection and to have slightly higher cell counts, this may explain somewhat the slow response in herd five.[9]

Discussion

This study confirms that some herds utilizing TD+DT programs either do not respond or respond slower than is expected. Usual speculation about negative or delayed response due to purchased additions, dirty environment and intermittent use of the program seem to be corroborated in three of the five herds studied (herds 2, 3 and 4).

In addition, responses in herd No. 1 following lengthening of milking time indicates that incomplete milkout is a limiting factor. Other problems implicated in this study as possibly limiting response to TD+DT programs include: Johne's disease, prolonged calving interval reducing the frequency of dry treatment, and low culling rates which result in higher than average age of the herd. Wide bore liners are also suspect (Herd five).

It seems also, that in this study, altering machine function was not particularly beneficial to these herds and, in one case, failure of the operator to adjust to slower milking function may have complicated his problems.

400 mg of novobiocin for dry treatment seems to be efficacious against *Streptococcus agalactiae,* based on apparent elimination of this organism from three herds.

Overall results in this trial in reducing infection are not as good as would be anticipated from the results in other larger trials using other antibiotics as the DT component. The data from this study, however, do not support nor contraindicate a decision to select the 400 mg novobiocin for dry cow infusion. Because of many variables and possible complications in these five herds, objective criteria for deciding to use or reject 400 mg of novobiocin as the DT component are not possible as a result of this study.

Table 5.
Herd No. 5
Infection Prevalence
Staphylococcus aureus, Streptococcus agalactiae (Sag), Streptococcus dysgalactiae and *Streptococcus uberis*

Date	Infected/Cultured	Prevalence	Note
1977	36/45	57.7%	No Sag
1978	16/42	38.0%	No Sag
1979	14/45	31.1%	No Sag

WMT Scores
Average of (n) tests prior to herd visit

Date	(n) Tests	mm
11/77	6	20.8
11/78	5	20.1
11/79	6	19.1
4/80	5	18.4

Production

Date	Cows	Herd Average Milk (lb)	Fat (lb)
11/77	55.5	16,429	613
11/78	53.2	19,096	678
11/79	49.4	19,642	725
4/80	49.9	19,383	708

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