COOLING PONDS AND MILK QUALITY

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The effects of heat stress on reducing milk production has been studied for many years (3). It has been perceived that heat stress is only a problem in the Sunbelt states. The weather conditions of 1988 has demonstrated that heat stress can be a big problem in the non-Sunbelt states also.

One method used in Florida to reduce heat stress on dairy cattle is the use of cooling ponds. Effects of cooling ponds and mastitis was presented at the 1987 National Mastitis Council Meeting (4). Much interest was generated from that presentation. This presentation will discuss the effects of cooling ponds on reduction of heat stress, types of ponds, pond water quality, the future of ponds and their effect on milk quality in the state.

Cooling Ponds On Reduction Of Temperature

In the summer of 1986, an experiment was carried out on a North Florida dairy who was using man-made cooling ponds (1). Ten early lactation Holstein cows were fitted with radio transmitters which transmitted inner ear temperatures every 5 minutes to a radio receiver and data logger. Data was collected over a 4 day period in mid-August. The cows activities were also monitored during this time, entering and exiting the ponds, eating, drinking and laying.

The cooling ponds lowered the cows temperature by 1-2^{o}F depending on the time of day they entered the cooling ponds. The average length per stay in the pond was 18 minutes for events from midnight to noon and 12 minutes per visit from noon to midnight. It is obvious that cooling ponds cool cows.

Types Of cooling Ponds

Man-made ponds are dug earthen ponds of various dimensions, depending upon the number of cows in that particular lot. They usually have running water in and a exit or drain pipe or overflow. Usually the ponds drain or overflow is from the top of the pond.

Cement ponds are also being built. These ponds are draining from the bottom and can be used to flush an existing barn or loafing area. Bottom drainage will hopefully remove some of the solids from the pond.

The drainage water from many ponds end up in the lagoon or lagoon type low spot from which water can be irrigated to pasture land.

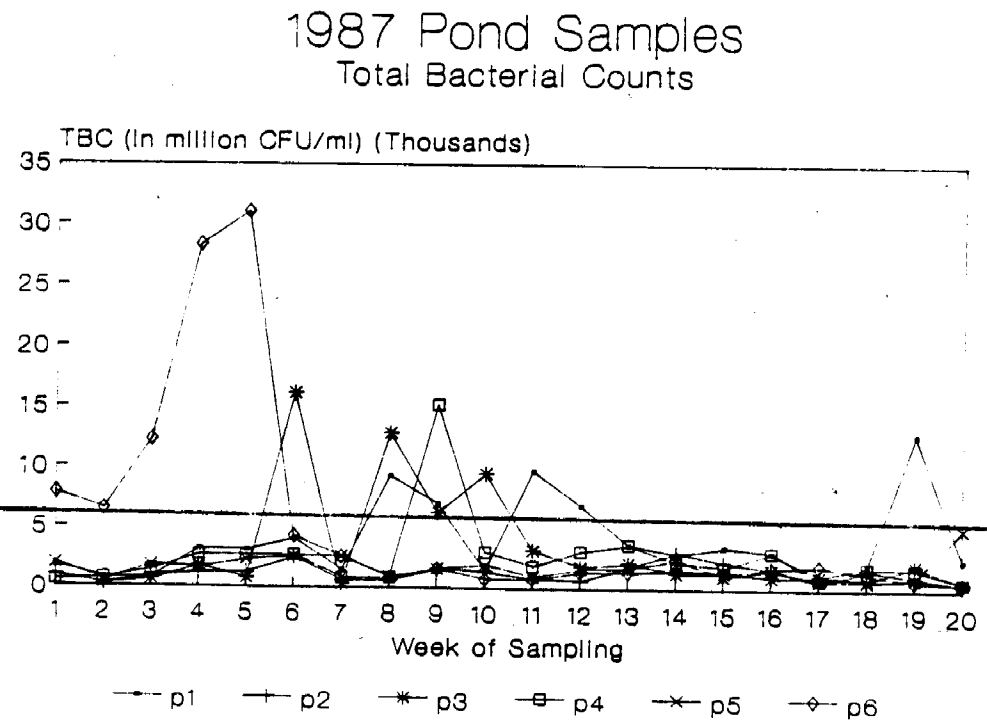
Natural ponds are varied in size and water supply in and out may depend on rainfall, springs or from a well. They may be depressions in the ground with running water through them or filthy mud holes.

Pond Water Quality

In 1987, samples were taken from a dairy's man-made earthen ponds. The ponds were sampled weekly from May 19, 1987 to September 28, 1987. Six to ten ponds were sampled each week. Some ponds were void of cows and were not sampled.

Total bacteria counts (TBC), vary greatly from week to week. This may be due to no water entering the ponds, etc. There does not seem to be any great increase in total bacteria counts (Figure 1) or Coliform counts as time progressed (Figure 2).

The total bacteria count averaged 3,133,700 CFU/ml for all ponds for the 20 weeks. The coliform counts averaged 14,340 CFU/ml for the same period (Figure 2).



What Areas Of Research Should Receive Emphasis

This question was asked to get the dairymen's input to what we should concentrate our efforts on to reduce environmental stress. Eighty-one dairymen or 38% of the respondents indicated cooling ponds should be studies.

As you can see, cooling ponds in Florida are not some passing fancy, but dairymen are using them and more dairymen are going to use them to help relieve environmental stress.

Cooling Ponds And Their Effect On Milk Quality

In a previous study on a dairy in Florida with man-made cooling ponds, it was reported that cows exposed to cooling ponds did not experience more clinical mastitis than cows who did not have access to cooling ponds. In fact cows exposed to ponds during the trial period were only half as likely to develop a case of clinical mastitis as cows not exposed to cooling ponds (Table 1).

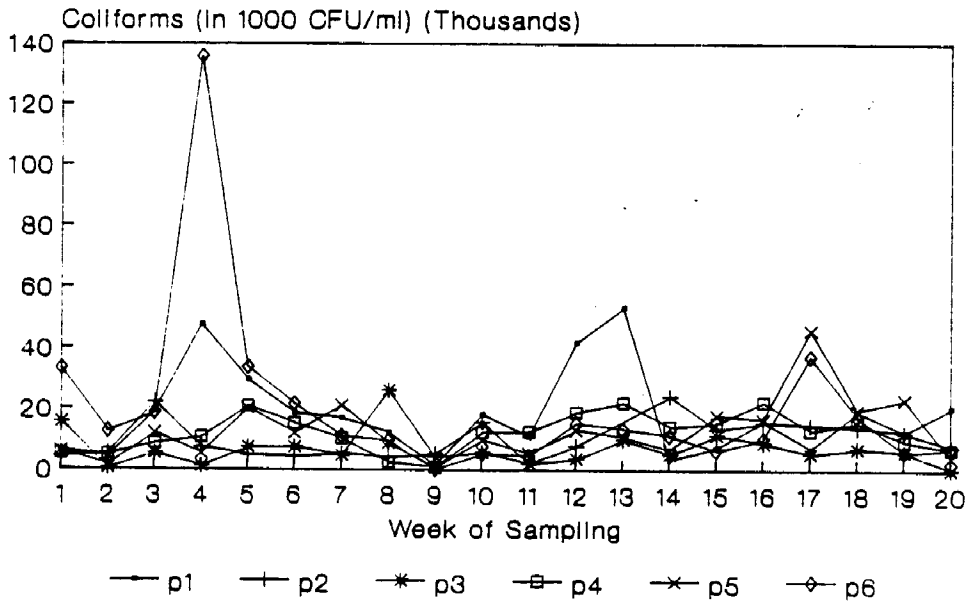
TABLE 1. Incidence of clinical mastitis - 1986.

Group	# Cows	# (%) Cows clinical	# Qtrs	# (%) Qtrs clinical
Ponds	817	79 (9.8)[a]	3268	95 (2.9[a]
No Ponds	375	70 (18.6)[b]	1500	96 (6.4)[b]

- a differs from b ($p < .01$)

This same dairy has been providing us with their clinical mastitis records for the past several years. The total number of clinical mastitis cases (Figure 3) was high in the first quarter of the year and then declined sharply about the time hot weather came and the cows started using the ponds. The incidence stayed low even in the last quarter of the year when the ponds were not in use. This can be explained many ways. The first quarter of the year was an extremely wet period. The cows were quite dirty and the cow wash system was available to one-half of the herd. This may explain some of the variation, even though one-half of the herd never has had a cow wash. Another confounding variable is that this herd switched to Clorox for pre- and post- teat dipping in April of this year. It had previously pre- and post- dipped with a Chlorhexidine product. From this we could conclude that the Clorox was the cause in reduction of clinical mastitis. Since there were no controls in this study, I will conclude nothing except that the ponds did not increase clinical mastitis.

1987 Pond Samples
Coliform Counts



A natural question that may be asked is why do any research on cooling pond? There can't be more than a couple of dairies in the world that have them anyway.

Environmental Stress Survey

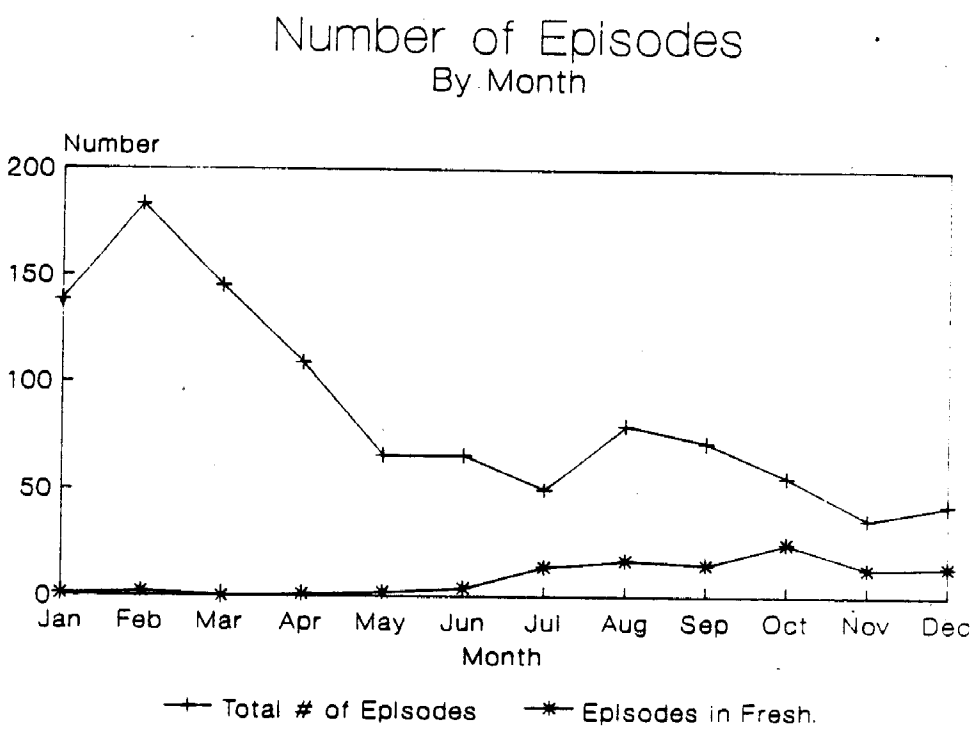
In February of 1988, an Environmental Stress Survey (2) was mailed to every dairy in the state of Florida. 347 surveys were sent out, 15 never reached the dairies. 212 (64%) surveys were completed and returned. The reason for this survey was to obtain base line data presently used on Florida dairies to reduce environmental stress. This data will be used to develop future research and extension efforts in this area.

Methods Presently Used To Provide Relief From Environmental Stress

This section of the survey was to determine what dairymen are now using to relieve environmental stress. Seventeen percent of the respondents indicated that they used natural ponds and 15% indicated that they used man-made cooling ponds. At the present time 68 dairies in Florida are using cooling ponds.

Future Plans to Reduce Environmental Stress

The question was asked of the dairymen, what they planned to do in the next 2 years to reduce environmental stress. 24 dairymen or 11% of the respondents indicated that they were going to build cooling ponds.



Clinical Mastitis Organisms

This herd was on a lactation treatment study during the summer of 1987 (Table 2). A total of 40 cows were sampled and treated. There were no unusual organisms treated. These 40 cows were in no way all the cows treated for clinical mastitis during the period the cows had access to the ponds, but the results are encouraging.

TABLE 2. Clinical Mastitis Organisms - 40 clinicals

Organism	Staph. aureus	Staph. species	Strep. ag.	Strep. dys.	Strep. uberis
#	3	2	0	4	9

Organism	E. Coli.	Other Gram Neg.	C.Pyo.	C. Bovis	Nocardia	No Growth
#	4	3	1	1	3	10

DHIA Somatic Cell Counts

In Table 3, data from DHIA for this herd is listed. Several observations can be made from this data. The first being that milk production did not drop in the summer months as is usually the case in Florida in the summer. This is the reason that the owner has the cooling ponds. The second observation is that the DHIA somatic cell count did become elevated during the summer months but not by a great

degree. It should also be noted that average days in milk also increased during this period. In this herd somatic cells did not increase greatly during the hot weather and milk production did not decrease.

TABLE 3. DHIA Information - 1987

Month	# Milking Cows	Ave. Days In Milk	RHA	Ave. SCC
1	1597	134	17472	2.9
2	1634	149	17436	2.9
3	1582	165	17489	2.7
4	1524	190	17622	3.2
5	1541	198	17621	2.9
6	1561	194	17644	3.0
7	1480	197	17717	3.2
8	1383	184	17730	3.4
9	1410	166	17648	3.6
10	1424	143	17734	3.4
11	1595	129	17804	3.1
12	1711	125	17874	2.8

Statewide Effects Of Ponds On Milk Quality

Regulatory samples for all the herds in Florida were obtained from the Division of Dairy Industry for the year of 1987 were analyzed for the effects of no ponds, man-made ponds and natural ponds. The numbers presented are least squares estimates of SPC (Standard Plate Counts) and DMSCC for each month. They are not biased by different numbers of dairies with no ponds, natural or man-made ponds. Since dairies from the environmental stress survey indicated if their milking cows had access to cooling ponds we analyzed the data by herds whose milking cows had access to ponds.

Figure 4 illustrates the L.S. means for SPC the year for all herds in Florida, with the trend of higher L.S. means SPC during the summer months.

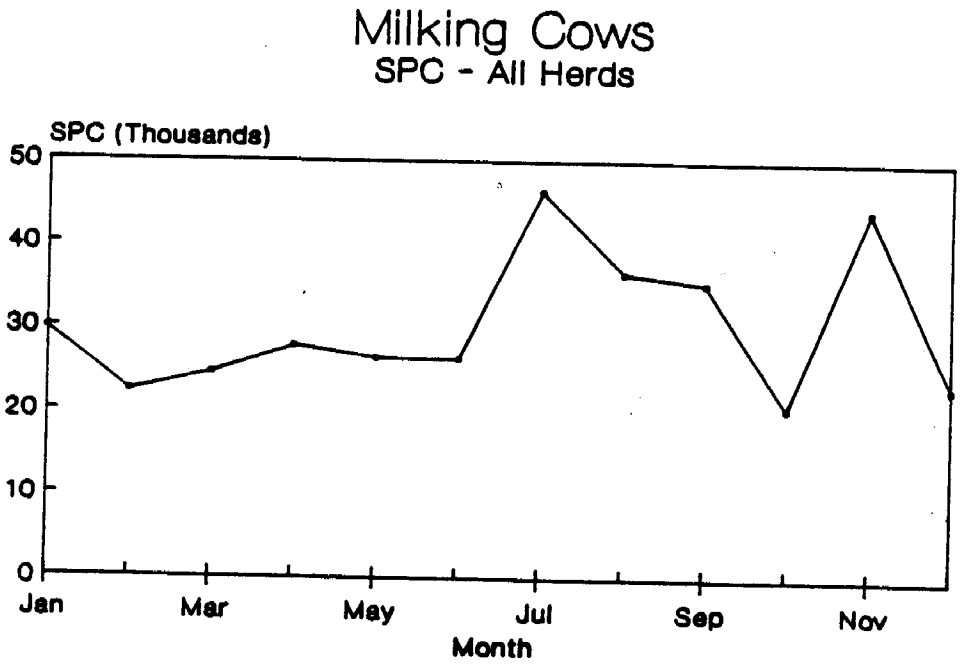
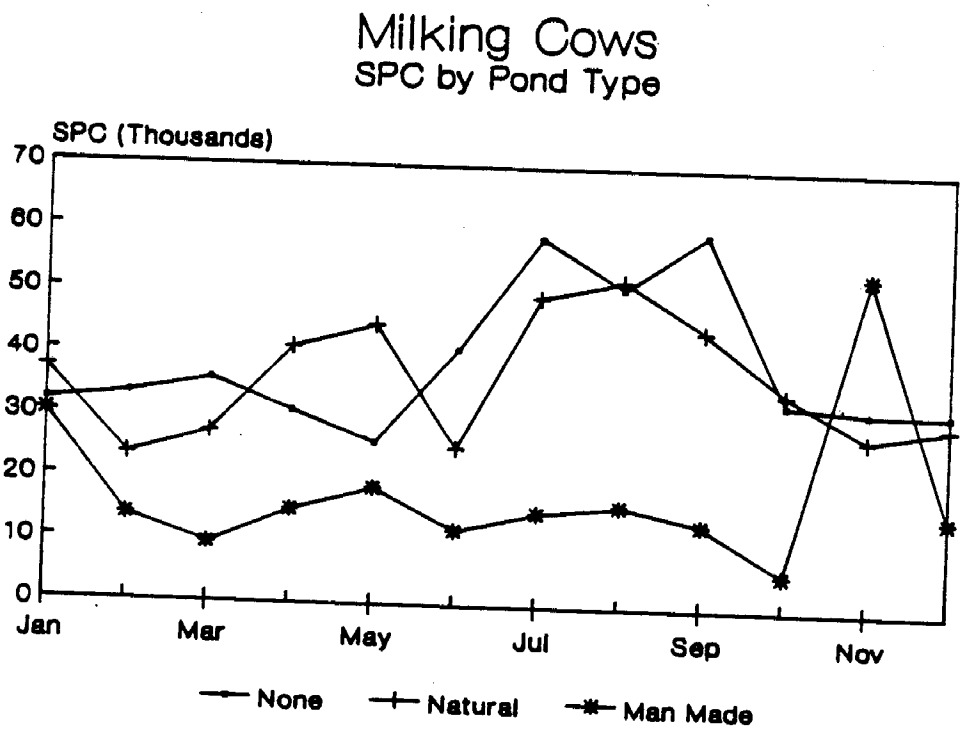


Figure 5 is a graph by months of L.S. means SPC for herds with no ponds and natural and man-made pond herds. The man-made pond herds were lowest for most of the year except for November which was higher.



From Table 4, the L.S. means for the year for standard plate count (SPC) for herds with milking cows with access to pond's herds with man-made ponds had the lowest SPC, L.S. mean 18,151 for the milking cows compared with a L.S. mean SPC for natural ponds of 36,322 for milking cows. Herds with no ponds had a L.S. mean SPC of 38,635 for milking cows.

TABLE 4. L. S. Mean of SPC by Pond Type.

Herd	No Ponds	Natural	Man made
SPC	38635	36322	18151

Table 5 presents the L.S. means for the year for somatic cell count (DMSCC). Again, the man-made ponds were the lowest with a L.S. mean of 395,497 for the milking cows. Herds with no ponds had L.S. means DMSCC of 460,056 for milking cows. The herds with natural ponds had the highest L.S. means for DMSCC, 524,412 for the milking cows. Herds with man-made ponds had the lowest DMSCC and the herds with the natural pond had the highest DMSCC.

TABLE 5. L. S. Mean of DMSCC by Pond Type and Herd.

Herd	No Ponds	Natural	Man made
DMSCC	460,056	524,412	395,497

Figure 6 illustrates the L.S. means for somatic cell counts for all herds in Florida, showing a increase in DMSCC during the summer months.

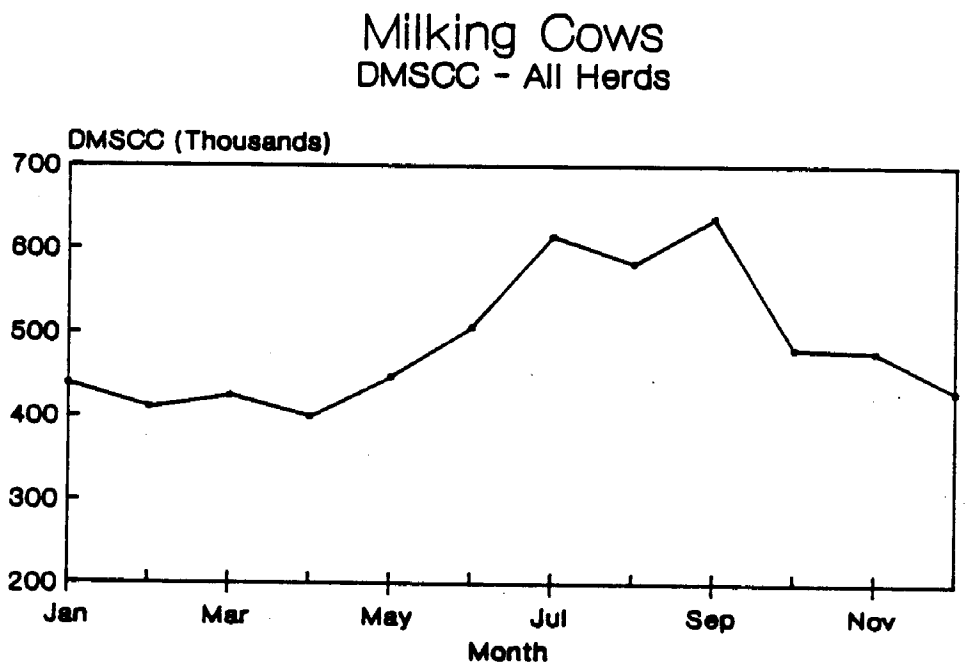
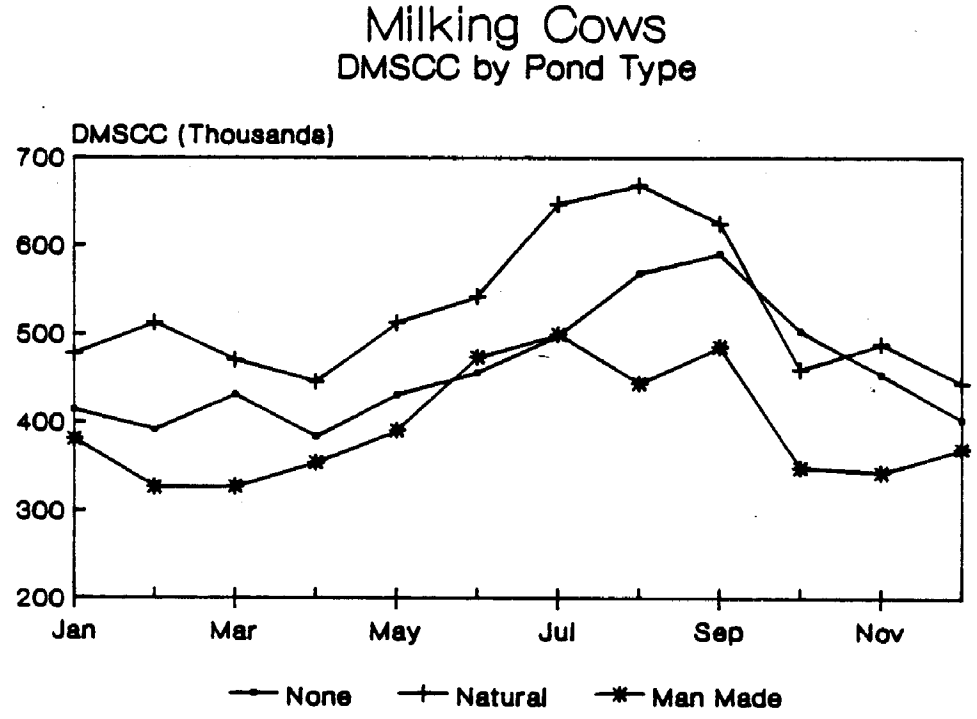


Figure 7 graphs by months the L.S. means DMSCC for herds with no ponds, natural pond and man-made ponds. Like SPC the DMSCC was lowest for man-made ponds and highest for natural ponds.



It seems obvious from the data for milking cows with access to man-made cooling ponds had lower SPC and DMSCC counts than other herds in the state and that herds with natural ponds were higher in both categories. It could be argued that people who built man-made ponds are better managers and thus have higher milk quality or that natural ponds are mud holes. We presented the data, you can draw whatever conclusions you wish.

Summary

From the data we have collected on cooling ponds we can conclude that cooling ponds are effective in cooling cows. There are 32 percent of the dairies in Florida with cooling ponds and more will be built. Man-made cooling ponds don't seem to increase clinical mastitis and herds with man-made cooling ponds have higher quality milk as measured by standard plate count and somatic cell count. Herds with natural cooling ponds have decreased milk quality than herds with man-made ponds or herds with no cooling ponds.

References

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