

# Teat End and Skin Conditioning Evaluation of Two Experimental Heptanoic Acid Teat Dips During Winter

## A.S. Leaflet R2315

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### Summary and Implications

Winter conditions can lead to rapid dehydration and cracking of teat tissue, thus increasing mastitis risks. The purpose of this study was to evaluate the teat end health and skin conditioning performance of two experimental heptanoic acid based teat dips vs the commercial product Remain Gold<sup>®</sup> using a split udder design during the winter season under best management winter milking practices. The experimental heptanoic acid teat dips KX-6185 and KX-6186 showed similar teat end health and teat skin conditioning to Remain Gold under winter conditions. Marked changes in teat end scores were measured over time and over periods as short as days. On the other hand, product treatment comparisons frequently showed parallel trends in score averages. This illustrates the importance of a split udder design to evaluate skin conditioning performance. The split udder design minimizes the risk of experimental bias due to cow and environmental factors. Most reported teat skin studies rely on comparing teat dips in separate cow groups with little consideration to group balancing even though factors such as hyperkeratosis is known to be affected by cow age and lactation stage. This study illustrates the high risk of traditional design skin toleration studies inaccurately attributing effects to teat dips.

### Introduction

Maintaining good teat skin health is recognized as important element in mastitis prevention and animal welfare. Also, rapid teat end changes can occur during winter), and to counter such effects, the use of salves and teat dips with extra skin conditioners have been commercialized and promoted as a means of maintaining soft and pliable skin and healthy teat ends. All potentially new teat dips should have both teat end and teat skin health data evaluation, and show excellent teat health prior to commercialization. Two experimental teat dips were developed comprising heptanoic acid as the active ingredient to offer farmers an alternative to iodine products. Experimental teat dip KX-6185 is a thickened formulation comprising 1% heptanoic acid and a 10% skin conditioning system that is intended for use as a pre- & post-milking disinfectant. Experimental teat dip KX 6186 is a similar formulation that contains film-forming polymers and is intended as a post-milking barrier product. The purpose of this study was to evaluate the teat end health and skin

conditioning performance of two experimental heptanoic acid based teat dips vs the commercial product Remain Gold<sup>®</sup> using a split udder design during the winter season. The skin conditioning performance of these products was assessed by comparison to Remain Gold<sup>®</sup>, a non-iodine based barrier teat dip that is marketed as having superior skin conditioning and is recommended as a winter teat dip. A split udder design study was performed during winter to minimize the risk of experimental bias and maximize the chance of seeing teat dip effects.

### Materials and Methods

Two separate teat dip trials were conducted simultaneously at the Iowa State Dairy Farm from late October 2006 through March 2007 in accordance with the final protocol dated 10/27/06. All trials and protocols were also approved by the Iowa State University Committee on Animal Care. In addition, data was collected from the fresh cow pen where all teats were dipped with the standard iodine pre-milking and post-milking teat dip products used at the farm.

Experimental teat dips KX-6185 (Formula Code 912229) and KX-6186 (Formula Code 912230) were provided by Ecolab (Ecolab, St Paul MN). Both products contained 1% heptanoic acid and 10% skin conditioners dominated by glycerin. Remain Gold<sup>®</sup> (Anfo Manufacturing Co., Oakland CA) was purchased commercially. The label active ingredient is Bronopol (0.2%) and skin conditioners comprise a 6% combination of glycerin and propylene glycol<sup>2</sup>, and proprietary polymers from Hydromer. Derma Soft n Dry (IBA), a powder dip containing chlorhexidine was used as a post milking disinfectant for 5 weeks following the trial (during extreme cold conditions). The standard post-milking iodine dip used at the start and end of study was Quadraplex (IBA, 0.5% iodine, 10% emollient), while the pre milking teat dip was a 0.25% iodine, 2% skin conditioning product (BacStop, IBA).

All trials used a split udder design. In trial 1 (Pen 1 Free Stalls), left teats of 56 cows were pre-dipped with 0.25% iodine teat dip (IBA) and post dipped with Remain Gold<sup>®</sup>. Right side teats were pre and post dipped with KX-6185. In trial 2 (Pen 2 Free Stalls) 56 cows had teats pre-dipped with a 0.25% iodine dip. Left teats were post-dipped with Remain Gold<sup>®</sup> and right teats were post-dipped with experimental teat dip KX-6186. Subclinical and clinical mastitis were monitored. Cows were milked twice a day in a double 8 herringbone parlor. Cows were forestripped (3 strips/teat) and pre-dipped (4 cow sequence), then dried with terry cloth prior to milker unit attachment. Automatic detachers were set at 2 lb. flow rate and 2 second delay. Both Pens (1 & 2) were housed in free stall barns with sand

bedded stalls. Pen 1 animals had a 100 yard walk (open environment travel lane) to their barn but feeding was inside the barn. Pen 2 had a 30 yard walk (open environment travel lane) and feeding mangers were outside the barn.

Data collection was initiated on October 30<sup>th</sup> and continued until March 4<sup>th</sup>. Test products were applied starting November 6<sup>th</sup> or on the 7<sup>th</sup> day of the trial. Experimental product treatment was discontinued January 12<sup>th</sup> or day 74 of the trial. Between January 12<sup>th</sup> and February 19<sup>th</sup> (days 74-112 of trial) all teats were treated after milking with Derma Soft n Dry, a powdered teat dip. After February 19<sup>th</sup>, all teats were post-dipped with Quadra-Plex (0.5% iodine).

Teat skin and teat end scoring was performed using a variation of the Goldberg and Timms methods, respectively, by trained graders (Tables 1 and 2). Scoring was performed twice per week. Results were compiled and analyzed using Microsoft Office Excel 2003. Weather conditions during the trials were also compiled via the National Weather Service Climatological Data for the Des Moines station.

### Results

Average teat skin and teat end results for trial 1, 2, and fresh cows (control – no trial) are presented in Figures 1-3. There were no significant differences in teat end and teat skin condition between udder halves in all trial. However, there was significant teat changes across udder halves and time, signifying other factors beside dips contributing to teat condition issues.

The average daily temperature values are presented in Figure 4. Very low temperatures were seen ~ day 77 of the trial and changes to a winter dip were made. Results from Figures 1-3 show all trials and groups of animals had significantly poorer teat condition during this cold period, with groups exposed to outside feeding and more prolonged cold exposure having higher scores and teat end problems.

A comparison of the average teat end scores for the left teats from trial groups 1 & 2 vs the average daily temperature is presented in Figure 5.

### Discussion

Overall, teat skin and teat end scores between the experimental products and Remain Gold<sup>®</sup> were comparable. Teat skin scores were good throughout the trials with no meaningful change over time. Teat End score averages trended up after the start of the trial, but average teat end score differences between treatments were small.

The study objective was to demonstrate that the experimental teat dips were at least equally well tolerated on teat skin and teat end as Remain Gold. Proper statistics to assess non-inferiority for the non-parametric ordinal data has yet to be determined. Regardless, the magnitudes of difference between treatments were small and within the

potential method variation. Average treatment differences in teat end scores ranged from (-0.23, +0.24) for trial group 1, (-0.21, +0.11) for trial group 2, and (-0.18, +0.24) for the fresh cow group. Ideally, when left and right teats are dipped with the same product, one would expect no differences in average scores. The differences for the fresh cow group and the study groups when all teats were dipped with the same product were of the same magnitude as the differences seen during the test product treatments. Therefore the observed differences may reflect the inherent variability in the test method.

Weather is an important element in skin health. It is generally believed that rapid changes of weather can cause skin health issues. Some evidence of weather effects were found, but not conclusive. There were sharp increases in average teat end scores on day 13 and day 58 of the trial that were observed in both study groups. The first sharp increase occurred after a significant shift in daily average temperature from 63F to 29F from days 9-12 of the trial. However, prior to the sharp increase on day 58, average daily temperatures ranged between 31-35F. There were prolonged elevation in average teat end score in both groups for the 5 weeks following the trial when temperatures were very low, even though a powder based winter dip was utilized. Graph 5 presents the teat end scores for the left teats (Remain Gold) from the two study groups vs average daily temperature. The scores for the two groups trend together but do not consistently correlate with any particular temperature trend. The score trends between groups are remarkably similar and suggest that either some factors beyond the teat dip was having a significant influence on the teat ends, or that there is a degree of self benchmarking by the grader between study groups on any particular grading period.

### Conclusions

The experimental heptanoic acid teat dips KX-6185 and KX-6186 showed similar teat end health and teat skin conditioning to Remain Gold under winter conditions. Marked changes in teat end scores were measured over time and over periods as short as days. On the other hand, product treatment comparisons frequently showed parallel trends in score averages. This illustrates the importance of a split udder design to evaluate skin conditioning performance. The split udder design minimizes the risk of experimental bias due to cow and environmental factors. Most reported teat skin studies rely on comparing teat dips in separate cow groups with little consideration to group balancing even though factors such as hyperkeratosis is known to be affected by cow age and lactation stage. This study illustrates the high risk of traditional design skin toleration studies inaccurately attributing effects to teat dips.

**Table 1. Teat Skin Scoring Scale.**

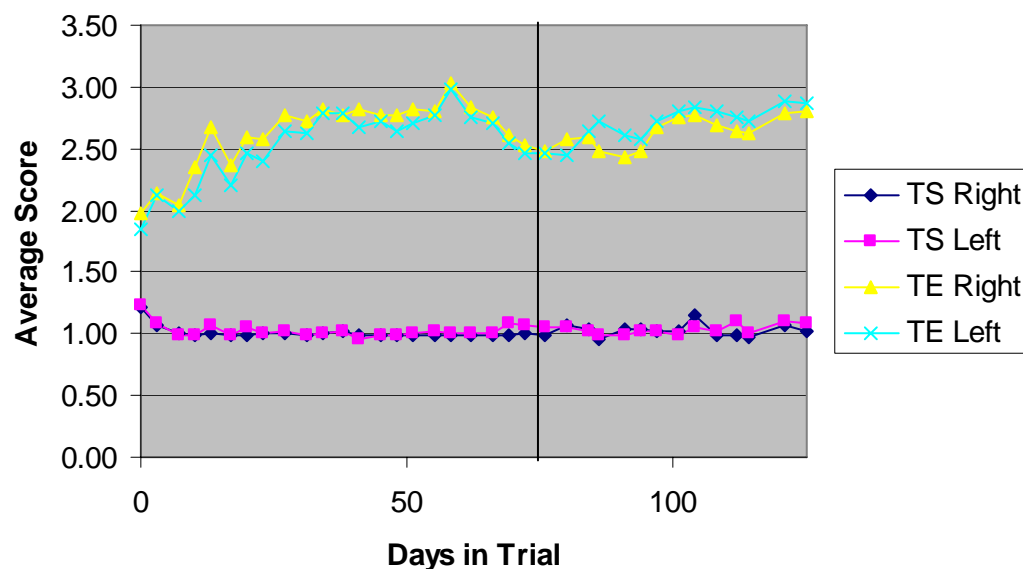
Score	Description
0	Teat skin has been subjected to physical injury ( stepped on/ frost bit)
1	Teat skin is smooth, soft and free of any scales, cracks, or chapping.
2	Teat skin shows some evidence of scaling especially when feeling (areas of dryness by feeling drag when sliding a gloved hand along the teat barrel &/or seeing areas of lower reflective sheen to the surface of the skin).
3	Teat skin is chapped. Chapping is where visible bits of skin are visibly peeling.
4	Teat skin is chapped and cracked. Redness, indicating inflammation, is evident.
5	Teat skin is severely damaged / ulcerated / open lesions.

**Table 2. Teat End Scoring Scale (0-5).**

Teat End Scoring system	Degree of hyperkeratosis or callousing				
	none	minor	mild	moderate	severe
Cracking					
No cracking	1	1.5	2	2.5	3
Cracked	---	3.5	4	4.5	5

\* zero score – physical injury of teat

### Split Udder Skin Conditioning Study Group 1



**Figure 1. Average Teat Skin (TS) and Teat End (TE) scores for trial group 1 comparing the Left (RG) and Right (P/P) teats. The Experimental treatments Remain Gold (RG) and pre/post dip KX-6185 (P/P) were applied between 7-74 days in trial. Vertical line demarcates end of trial and the initiation of 5 weeks of post dipping with powder teat dip during cold weather.**

### Split Udder Skin Conditioning Study Group 2

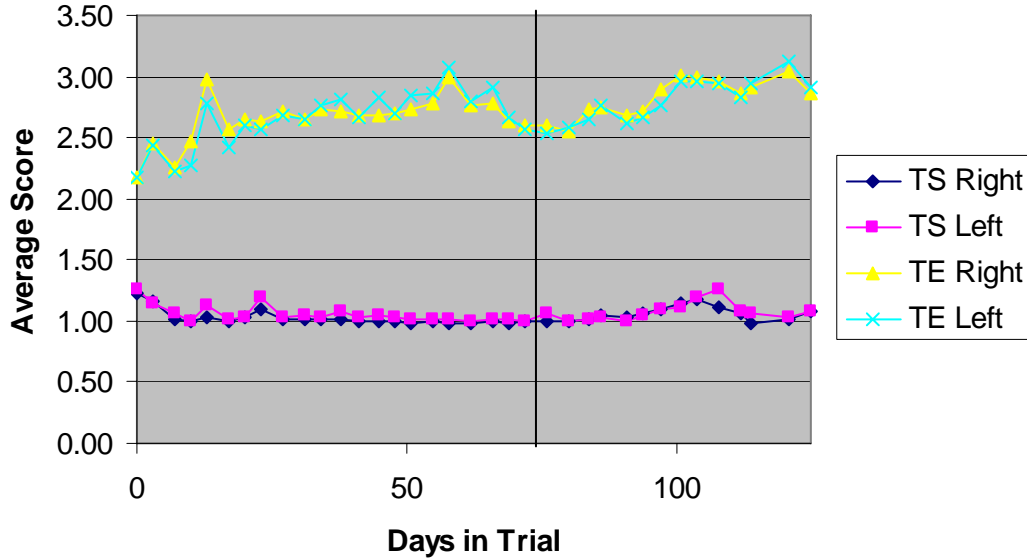
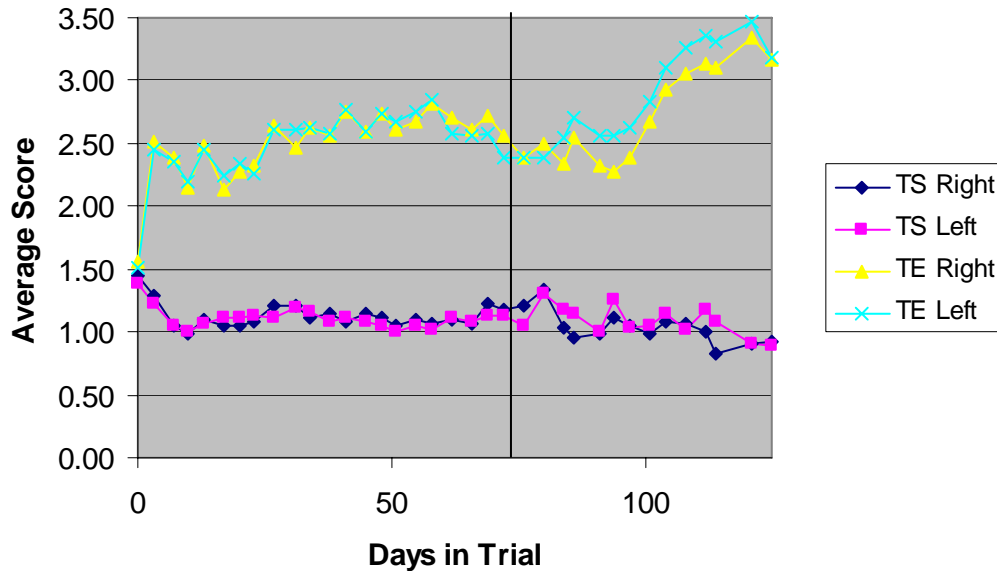


Figure 2. Average Teat Skin (TS) and Teat End (TE) scores for trial group 2 comparing the Left (RG) and Right (B) teats. The Experimental treatments Remain Gold (RG) and barrier dip KX-6186 (B) were applied between 7-74 days in trial. Vertical line demarcates end of trial and the initiation of 5 weeks of post dipping with powder teat dip during cold weather.

### Split Udder Skin Conditioning Study Fresh Cow Group



Graph 3. Average Teat Skin (TS) and Teat End (TE) scores comparing Left (L) and Right (R) teats of the fresh cow group. Vertical line demarcates end of trial and the initiation of 5 weeks of post dipping with powder teat dip during cold weather.

### Average Daily Temperature

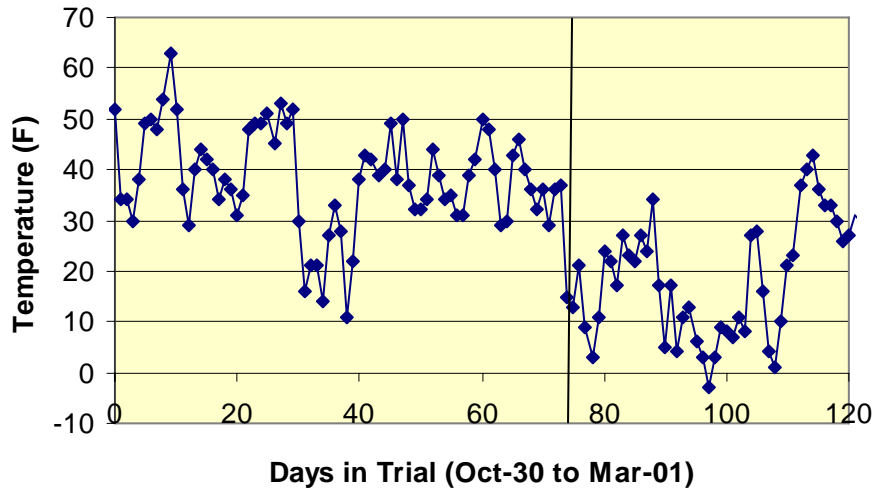


Figure 4. Average Daily Temperature from October 30 through March 01 reported as days in trial. Vertical line demarcates end of trial and the initiation of 5 weeks of post dipping with powder teat dip during cold weather.

### Comparison of Temperature and TE Scores

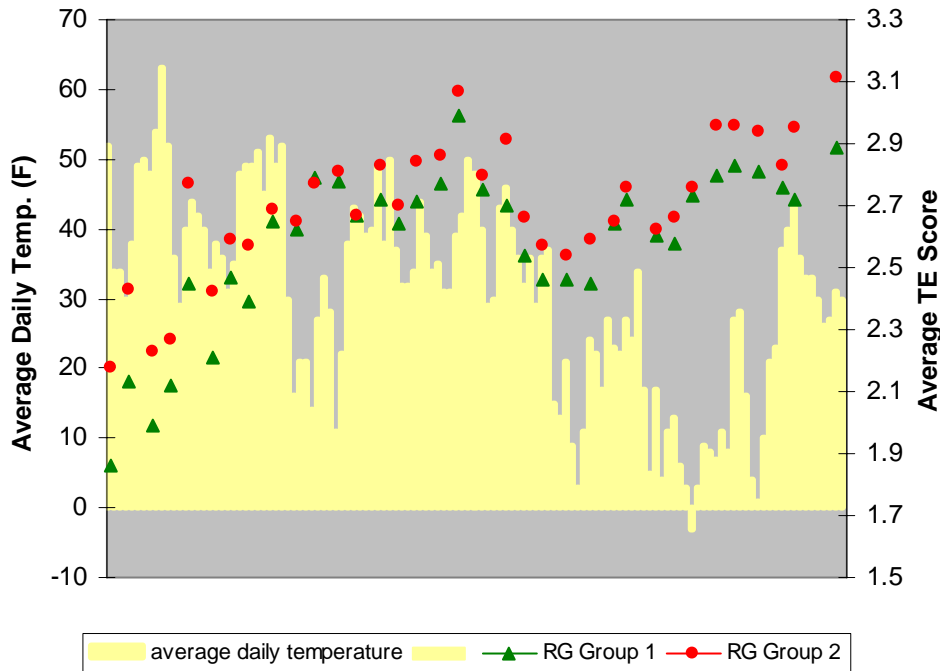


Figure 5. Comparison of average daily temperature (degrees F) and left teat end scores from trial groups 1 & 2 over days in trial from 0 to 122. Between day 7 and day 74 of trials, left teats were treated with Remain Gold (RG). Days 74-112, all teats were treated with powder teat dip. After day 112, all teats were dipped with iodine product.