SARE Grant 2006 Final Report:
Will More Precise Study Research Tools Lead to Reduced Use of Antibiotics to Prevent Cases of Mammary Infection During a Dry Period? FNE06-571

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1. Project Goals

Our 2006 study is a refinement of SARE-funded research originally carried out in 2004. In 2004, we studied whether the practice of treating every lactating animal with high dose intramammary antibiotic at dry off can be eliminated in lower risk cows by employing a teat sealant product. We identified 150 qualified study animals and randomly assigned them to one of three groups during weekly dry-off sessions: either Orbeseal only, Traditional dry off treatment (Quartermaster) only, or both treatments. Analysis of our finding indicated that each treatment method was equally effective, given the parameters for somatic cell count (SCC) and previous animal history of infection that we established for the study.

Project results were met with interest by farmers and agri-professionals, but study findings had to be applied with qualifications due to project constraints. To measure SCC and therefore sub-clinical infection for our study subjects, we relied on the monthly visit of our Dairy One technician. Testing was performed without regard to study participants' freshening dates, so SCC data on individual animals ranged from 30±15 days in milk (DIM). This range of test days, while the best we could do at the time of study, allowed for too large a margin of error. This testing method also initially exposed study animals to a greater health risk. Dairy One performed a baseline SCC on study animals up to a month before dry off. This window allowed ample time for an existing pre-treatment infection to be established.

In 2005, a commercial individual somatic cell counter was introduced for farm use. We realized use of this tool could reduce the margin of uncertainty created in the first study as well as make study findings more practical for use on a greater number of dairies.

For the work supported by this grant, we proposed replicating the 2004 study format, while employing the technological improvement of the on-farm cell counter unit. This unit allowed us to measure SCC at dry off and in each postpartum animal within a desired and more precise time range. More timely measurement of SCC at dry off and after calving enabled us to pinpoint if and when infections occurred. This study resulted in reduced heath risk for participating animals. Therefore, our goal for the 2006 study is to present more precise data and detailed study findings that are more readily usable for the farmer in the field.

2. Farm Profile

Table Rock Farm is currently a 1,050 cow, fourth generation dairy with 25 full and part-time employees. The farm's mission is to produce quality milk for the public need, and to be competitive with any area in the world in order to provide a good lifestyle for owners, employees and their families. About 1550 acres of hay and corn are cropped each year to feed cattle, and in 2007, the farm shipped almost 1.35 million pounds of milk per full-time employee equivalent. Up to 4,000 pounds of quality milk are harvested per hour, and we pride ourselves on our milk bacteria count below 3,000 and somatic cell count between 140,000-180,000.

3. Participants

The grant Project Leader is Willard De Golyer, owner of Table Rock Farm. In addition to grant management, he coordinated collaborators and monitored overall grant results and progress.

Catherine Book, Herdsperson at Table Rock Farm, designed the study protocol and record-keeping system. She was responsible for data collection and accuracy. Herd Manager Michael Lanpher, Herdsperson Thomas Nickerson and Ms. Book worked together to carry out the study protocols, including animal treatment, sampling and observation.

Leslie Scott De Groff, DVM, is the herd veterinarian. He is on farm premises weekly. Dr. De Groff helped shape the study protocol and monitored study progress and overall animal health.

Francis Welcome, DVM, is a Senior Extension Associate with Quality Milk Production Services in Ithaca, NY. He advised on grant design and secured statistical analysis of study data. Due to Dr. Welcome's other project commitments, his colleague, Dr. Ynte Schukken Director of Quality Milk Promotion Services and Associate Professor of Epidemiology and Herd Health, interpreted study findings.

Bradley Rauch is Manager of Contract Research at Quality Milk Production Services in Ithaca, NY. He performed statistical analysis for this grant, as he did for our 2004 study.

Meghan Hauser, owner of Table Rock Farm, acted as grant administrator and is carrying out the Outreach portion of this grant.

4. Project Activities

Experiment Structure and Process

Our study commenced in March 2006. During a weekly dry-off session, each cow to be dried off was tested for individual SCC level using a DeLaval Cell Counter DCC. This instrument allowed us to immediately know which animals were qualified for study inclusion, based on a SCC result under 200,000 and no clinical mammary infection during their current lactation. Eligible cows were randomly assigned to one of three groups at dry off:

1. Traditional dry off treatment with a commercially-prepared dose of one million units of penicillin and 1 gram of dihydrostreptomycin (Quartermaster®). (43 cows)
2. Administration of Orbeseal® only (45 cows)
3. Traditional dry off treatment, followed by administration of Orbeseal® .(43 cows)

A total of 131 animals were entered in the study.

All other aspects of the dry off process were identical for each study group. Following dry-off dry cows were housed separately from the lactating herd, first in a free stall pen and eventually in a special bedded-pack facility until they freshened (gave birth) and returned to the milking herd. After giving birth, study participants return to freestall facilities.

At freshening, animals were tested for signs of mastitis with a California Mastitis Test (CMT). This test mixes an individual milk sample with a reagent to estimate the number of white blood cells present (an indicator of infection). An individual SCC test was also performed in the milking parlor on each study animal postpartum day 6±3 during the normal milking schedule. We waited a minimum of three days before taking a milk sample for SCC as colostrum of a recently fresh animal normally has elevated SCC levels.

Any milk sample that showed a positive CMT result or that registered a SCC count greater than 250,000 was cultured in our on-farm milk lab to further identify the infection causing agent.

Any animal in any test group that contracted a mammary gland infection was treated according to our standard protocol.

Data Collection

Study variables were collected in written form at various treatment locations around the farm, including the dry off area, the calving pen, and the milking parlor. Records were then transcribed into an Excel format, which was submitted for statistical analysis.

Other data gathered, but not expressly used for study findings include:

1. Daily records of individual milk production via the Afikim system.
2. Records of the course of known infection and treatment in study animals
3. Calving experience (calving ease, size, condition)
4. Expenses.

Our farm veterinarian had access to all study records during his weekly herd checks, and Dr. Francis Welcome was available for consultation via e-mail.

5. Results

The complete data set was submitted to Quality Milk Production Services for statistical analysis in January 2007. In June 2008, Brad Rauch, Manager of Contract Research at Quality Milk, and Dr. Ynte Schukken performed the analysis, using Microsoft Excel, Statistical Analysis System v9.1(SAS). Their methods and findings follow:

Methods

All cows enrolled in this study had a SCC below 200,000, before dry off. A subclinical infection was defined when a cow measured SCC above 200,000 at freshening. Descriptive statistics for study variables (treatment, drydays and season) were produced using PROC FREQ. A logistic regression analysis, using PROC LOGISTIC was performed to evaluate the effect of treatment on the prevalence of new subclinical infections. Season and days dry were included in the model as modifiers, and separately as interaction terms with treatment.

The variable definitions and models that were evaluated are as follows:

Variable definitions:

Trt = treatment (Orbeseal, quartermaster, orbeseal+quartermaster)

Drydays = number of days each cow was dry (≤ 50, > 50)

Season = Whether or not calving occurred in "Spring", "Summer" or "Fall" (May – June, July - Sept and Oct – Nov, respectively)

Logistic Regression models: *Subclinical = trt drydays season*

*Subclinical = trt drydays drydays*trt*

*Subclinical = trt season season*trt*

Terms that were not significant (P<0.05) were removed from the model. The final model terms and corresponding p-values are presented.

Descriptive Statistics Results:

Table 1. Sample size and percentage of cows with elevated SCC stratified by treatment.

Treatment	N	% Elevated SCC
Orbeseal	45	24.4
Quartermaster	43	18.6
Both	43	20.9
Total	131	21.4

Table 2. Sample size and percentage of cows with elevated SCC, stratified by treatment and drydays (≤50, >50).

	N		% elevated SCC	
Treatment	≤ 50 d	> 50 d	≤ 50 d	> 50 d
Orbeseal	17	28	17.7	28.6
Quartermaster	15	28	13.3	21.4
Both	17	26	23.5	19.2
Total	49	82	18.4	23.2

Table 3. Sample size and percentage of cows with elevated SCC, stratified by treatment and season ("Summer", "Fall").

	N			% elevated SCC		
Treatment	Spring	Summer	Fall	Spring	Summer	Fall
Orbeseal	12	25	8	16.7	28.0	25.0
Quartermaster	13	24	6	23.1	12.5	33.3
Both	12	23	8	16.7	13.0	50.0
Total	37	72	22	18.9	18.1	36.7

Logistic Regression Results:

No terms in the model were significant ($P<0.05$), therefore, all terms were removed. Below are the P-values associated with the Wald Chi-Square values for each model, during the selection procedure.

Model	Wald Chi-Square	p-value
Subclinical = trt drydays season	3.926	0.5601
*Subclinical = trt drydays drydays*trt*	1.6609	0.8938
*Subclinical = trt season season*trt*	6.8347	0.5546
Subclinical = trt season	3.7370	0.4428
Subclinical = trt drydays	0.8867	0.8286
Subclinical = trt	0.4518	0.7978

INTERPRETATION:

Orbeseal, Quartermaster and a combination treatment of both Orbeseal and Quartermaster were evaluated for their effect on SCC following calving. There were 131 cows enrolled in the study, with nearly equal numbers in each treatment group. Cows within each treatment group were also distributed fairly evenly amongst categories of secondary variables (season, drydays). The quality of the data and the balance between groups showed a great effort on the part of the trial coordinator and staff.

Overall, descriptive data showed that Orbeseal (alone) had a higher percentage of new infections compared to treatments containing Quartermaster (Table 1). This was also true for longer dry periods, when the data was stratified by drydays (Table 2), and for the summer months when stratified by season (Table 3). Unfortunately, there were no detectable differences between any of the three treatment groups in this study, regardless of which modifiers were in the model. The overall low number of elevated SCC cases (28 out of 131 possible), likely reduced the detection capabilities of the regression analysis.

In summary, this was a very well run study, with thorough data collection and design balance. The number of elevated SCC cases was relatively few, leading to limited detection of treatment differences (statistically speaking). The descriptive data shows trends toward Orbeseal (alone) being somewhat less effective, especially during long dry periods and summer months, but this statement can not be fully supported by the analysis.

6. Conditions

The study began with the dry off of initial study cows in late March 2006 with final study participants freshening in November. This study took place in Western New York.

7. Economics

During the study (2006), Orbeseal cost $6.50 per single animal treatment. A single treatment with Quartermaster cost $6.26. A treatment with both Orbeseal and Quartermaster cost $12.76. Interestingly, during our 2004 study, Orbeseal cost $7.60 per animal treatment and Quartermaster cost $5.55 for a total cost of $13.15 for treatment with both products.

At this writing in July 2008, Orbeseal costs $6.96 and Quartermaster $7.04, for a total of $14 for both treatments. One DCC cartridge for measuring individual SCC costs $1.66.

8. Assessment

We are pleased to have the direct SCC counter on the farm. With the added ability to measure SCC within a more reasonable range prior to dry off, we now have a much higher comfort level with all treatment options used in the study. We encourage farmers who wish to employ our study findings to strongly consider purchasing an on farm cell counter unit, with a current cost of $3,425 (Delaval model).

It was interesting to note that even with the more stringent parameters of this study, although there were possible trends towards Orbeseal alone being less effective, no statistical difference in the study treatments resulted. Therefore, we feel farmers can safely consider the following opportunities:

On-farm antibiotic use

Farmers can use Orbeseal alone to decrease the risk of on-farm antibiotic contamination. Decreased risk of contamination can only reduce associated costs of producing milk. Additionally, those wishing to produce an organic product can use Orbeseal alone to dry off animals, apparently without significantly affecting animal health.

However, each farm should carefully evaluate their Linear Score in relation to the score at Table Rock during the period of the study. A farm with a higher Linear Score may need to use both an Orbeseal and a traditional dry-off treatment.

Dry Treatment Expenses

Dry treatment is expensive and is performed on every lactating member of the herd. A farmer armed with this study can base his/her treatment decision on product cost and personal management style, with a reduced concern for a loss of product effectiveness. This choice becomes more important as the cost of a traditional dry treatment exceeds the cost of treatment with Orbeseal and with increased public interest in how milk is produced.

Orbeseal Use on the Farm

It should be noted that Orbeseal has left a residue in our milking equipment and milk tanks. In July 2008 we used a product called Remedy in our wash cycle ($200 for a 5 gallon pail, and we used 2 pails), which is designed for Orbeseal removal. It has taken a while for this buildup to occur, which comes from incomplete removal of Orbeseal prior to first milking after freshening, but it is an additional expense that farms should take into account.

Further Study

As indicated in the statistical analysis section, a replicated study with a larger study sample size might better indicate the effectiveness of using only Orbeseal at dry off.

9. Adoption

Currently at Table Rock, we use teat sealant alone when drying off any animal with a SCC less that 200,000. We use both a traditional dry treatment and Orbeseal when animals have a SCC over 200,000 at dry off, as when animals have a history of mastitis during their current lactation, and during extreme weather. Any animal that may not survive the duration of the dry period is treated with Orbeseal only.

9. Outreach

Appendix B includes a press release that was distributed to the following media outlets:

Locally:	Wyoming County Cooperative Extension's Agricultural News
	Perry Herald (weekly)
	Country Courier (weekly)
	The Daily News (daily regional)
Regionally:	Country Folks
	FarmShine
	Northeast Dairy Business Magazine
Nationally:	Hoard's Dairyman
	Dairy Herd Management

A study synopsis was shared with members of New York State's PRO-DAIRY Extension team, which consults with farmers across the State.

COW ID	GRANT #	FRESH DATE	DAYS DRY	SCC @ DRY	CMT	Culture	Day Scc Post	SCC @ POST	Culture Results	Comments
5646	1	7/23/06	71	147,000			6	315,000	nogrow	
5878	1	5/31/06	32	112,000		strep	5	60,000		
5897	1	7/1/06	42	183,000			6	43,000		
6076	1	10/4/06	55	167,000			8	240,000		sol10/16/06 f+l
6078	1	11/2/06	46	155,000			8	151,000		
6093	1	10/27/06	40	153,000			5	72,000		
6168	1	7/27/06	54	188,000			5	1,062,000	staph	
6211	1	9/23/06	49	65,000			6	66,000		
6217	1	8/14/06	37	68,000			8	75,000		
6253	1	5/10/06	39	95,000			9	286,000	nogrow	
6257	1	9/25/06	65	134,000			7	78,000		
6364	1	7/31/06	50	160,000			4	155,000		
6399	1	7/21/06	55	56,000			8	24,000		
6461	1	8/27/06	58	21,000			6	49,000		
6466	1	5/25/06	53	75,000			7	93,000		
6477	1	9/7/06	60	53,000			8	189,000		
6489	1	10/24/06	53	135,000			7	65,000		
6498	1	7/29/06	55	66,000			6	763,000	nogrow	
6499	1	6/10/06	50	136,000			5	156,000		
6505	1	7/6/06	54	33,000			6	304,000	nogrow	
6519	1	6/26/06	57	54,000			9	158,000		
6524	1	11/17/06	62	27,000			8	151,000		sol1/15/07
6526	1	8/20/06	58	145,000			9	2,515,000	nogrow	
6536	1	10/31/06	44	151,000			9	210,000		
6544	1	7/10/06	52	115,000			7	1,827,000	nogrow	
6553	1	8/4/06	54	180,000			6	102,000		
6558	1	7/29/06	55	62,000			8	65,000		
6563	1	5/16/06	51	173,000			7	61,000		
6569	1	6/9/06	48	91,000			9	47,000		
6573	1	5/11/06	46	91,000			8	85,000		
6594	1	6/5/06	52	13,000			8	175,000		
6596	1	8/4/06	49	129,000			7	105,000		
6599	1	6/26/06	52	56,000			9	25,000		
6601	1	6/22/06	61	45,000		strep	9	2,302,000	nogrow	
6605	1	6/23/06	48	35,000			6	44,000		
6642	1	8/25/06	56	50,000			5	75,000		
6644	1	8/7/06	44	89,000			8	178,000		
6646	1	9/4/06	50	85,000			6	80,000		
6657	1	9/23/06	56	165,000			4	115,000		
6674	1	9/16/06	49	81,000		nogrow	8	210,000		
6710	1	10/20/06	55	103,000			9	97,000		
7284	1	8/7/06	64	65,000			7	155,000		
7286	1	10/10/06	53	132,000			9	21,000		
7288	1	7/31/06	51	46,000			9	43,000		
7290	1	8/6/06	57	26,000			8	56,000		

COW ID	GRANT #	FRESH DATE	DAYS DRY	SCC @ DRY	CMT	Culture	Day Scc Post	SCC @ POST	Culture Results	Comments
5636	2	9/8/06	41	72,000			9	99,000		
5702	2	6/17/06	43	177,000			8	198,000		
5968	2	7/3/06	44	149,000			7	52,000		
5992	2	5/8/06	37	106,000			9	41,000		
6088	2	7/31/06	57	67,000			6	89,000		
6163	2	6/13/06	38	77,000			7	874,000	nogrow	
6176	2	10/28/06	41	75,000			8	86,000		
6191	2	9/30/06	50	128,000			6	237,000		
6389	2	6/18/06	50	112,000			7	151,000		
6402	2	8/4/06	54	112,000			8	125,000		
6428	2	6/4/06	43	73,000			6	163,000		
6433	2	7/25/06	51	173,000			6	39,000		
6453	2	7/28/06	54	40,000			7	5,453,000	ecoli	
6456	2	5/20/06	55	67,000			8	55,000		
6470	2	7/25/06	59	166,000			8	215,000		
6476	2	9/30/06	56	50,000			6	45,000		
6478	2	6/9/06	56	56,000		ecoli	5	545,000	ecoli	
6500	2	9/2/06	56	51,000			8	85,000		
6503	2	10/6/06	57	67,000			7	200,000		
6512	2	8/6/06	57	153,000			9	119,000		
6517	2	10/22/06	57	36,000			8	231,000		
6525	2	6/24/06	55	36,000			7	49,000		
6533	2	6/17/06	57	47,000		nogrow	8	7,610,000	nogrow	
6539	2	9/13/06	60	61,000			7	76,000		
6542	2	9/11/06	57	193,000			6	155,000		
6548	2	5/8/06	50	67,000			9	51,000		
6549	2	8/10/06	48	47,000			7	50,000		
6561	2	5/23/06	51	119,000			7	96,000		
6583	2	5/17/06	52	35,000			9	155,000		
6585	2	8/2/06	60	54,000			9	45,000		
6587	2	8/17/06	54	46,000			8	155,000		
6598	2	6/19/06	59	69,000			6	127,000		
6611	2	7/24/06	50	120,000			5	115,000		
6613	2	8/27/06	36	190,000		nogrow	6	155,000		
6614	2	7/25/06	45	43,000			7	76,000		
6616	2	7/21/06	55	153,000			8	195,000		
6624	2	10/18/06	60	62,000			9	12,000		
6649	2	8/22/06	52	102,000			5	159,000		
6669	2	11/9/06	54	66,000		nogrow	8	185,000		
6670	2	8/26/06	57	80,000			6	65,000		
6724	2	10/23/06	52	70,000			6	43,000		
7285	2	8/21/06	59	57,000			7	28,000		
7287	2	7/22/06	49	30,000			8	47,000		

COW ID	GRANT #	FRESH DATE	DAYS DRY	SCC @ DRY	CMT	Culture	Day Scc Post	SCC @ POST	Culture Results	Comments
4854	3	7/14/06	34	68,000			6	76,000		
5360	3	6/24/06	35	112,000		ecoli	7	672,000	ecoli	
5452	3	8/6/06	71	166,000			6	145,000		
5652	3	6/30/06	48	68,000		staph	9	78,000		
5824	3	9/28/06	49	109,000			6	15,000		
5967	3	6/4/06	43	189,000			5	211,000		
6067	3	6/15/06	40	178,000			5	94,000		
6203	3	8/1/06	39	56,000			8	115,000		
6209	3	9/3/06	42	78,000		nogrow	6	86,000		
6276	3	6/1/06	54	56,000			8	22,000		
6358	3	7/30/06	50	29,000			7	1,283,000	nogrow	
6411	3	6/8/06	55	40,000		nogrow	8	62,000		
6412	3	5/14/06	49	189,000			9	45,000		
6431	3	5/22/06	50	184,000			3	76,000		
6440	3	6/16/06	48	39,000			9	20,000		
6441	3	7/19/06	46	42,000			7	79,000		
6491	3	8/3/06	60	49,000			5	46,000		
6493	3	8/5/06	49	133,000			8	115,000		
6530	3	5/14/06	49	43,000			9	31,000		
6537	3	7/24/06	51	21,000			8	55,000		
6550	3	6/2/06	42	88,000			8	39,000		
6551	3	10/19/06	61	76,000			8	65,000		
6560	3	11/1/06	67	92,000			7	200,000		
6565	3	6/3/06	63	82,000			8	40,000		
6572	3	7/19/06	53	45,000			7	130,000		
6577	3	8/4/06	61	65,000			8	55,000		
6578	3	8/20/06	51	151,000			6	969,000	ecoli	
6607	3	9/5/06	59	69,000			7	45,000		
6643	3	8/30/06	60	116,000			9	95,000		
6650	3	8/20/06	58	152,000			7	339,000	nogrow	
6666	3	11/13/06	58	183,000		nogrow	9	210,000		
6675	3	9/18/06	58	94,000			8	85,000		
6683	3	9/7/06	54	34,000			9	55,000		
6703	3	10/13/06	63	127,000			8	65,000		
6709	3	9/25/06	58	39,000			7	52,000		
6714	3	10/15/06	58	132,000			9	85,000		sol 12/11/06
6736	3	11/5/06	49	138,000			8	200,000		
6810	3	11/2/06	55	89,000			6	243,000		
7281	3	8/20/06	57	14,000			7	71,000		
7295	3	8/1/06	52	29,000			8	45,000		
7297	3	9/19/06	52	82,000			6	167,000		
7299	3	7/19/06	54	27,000			8	29,000		
7474	3	11/3/06	56	47,000			8	159,000		