DEVELOPING A HYGIENE VALUE PROPOSITION FOR DEOSAN FARM HYGIENE PRODUCT PORTFOLIO

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Abstract

This project was aimed to study effect of Deosan product range in the milking parlor and ultimately on the milk quality. All the parameters like BMT-TVC (Bulk Milk Tank -Total Viable Count), BMT-SCC(Somatic Cell Count), Water TVC, Rinse water TVC, Cluster cup TVC and Teat swab TVC were monitored during pre treatment. Deosan product portfolio was implemented in the farm and same parameters were taken to compare the change after the treatment. BMT milk Microbial load was reduced by 96.94%. Fresh water TVC was reduced by 89.23% when treated with 0.25% Iodine. Coliform count was also reduced by 87.5%. CIP system was washed by 1% Divosan TC-86 in the morning and 1% Acidbrite-9 in the evening. TVC of rinse water was reduced by 99.99%. Coliform count was also reduced by 87.5%. TVC of Cluster cup was reduced by 99.63%. Through use of udder wash and Teat dip, teat surface swab showed reduction in the bacterial count by 93.55%. It was found that Deosan dairy farm hygiene product portfolio improves quality of milk at farm level. Prolonged use of the products may result in lowering down mastitis incidence in the herd, so it will lower down the losses due to mastitis.

Key words: *Hygiene, sanitation, somatic, coliform*

Dairy farming has been recognized as an important source of income and is more remunerative in comparison to crop production in India. Milk production in India is predominantly the domain of small farmers in mixed farming systems. The Indian dairy industry is predominantly controlled by the unorganized sector which accounts for nearly 80% in terms of milk volume handled. Only about 20% milk is handled through the organized sector, including the 10% that is run by the private sector. Majority of our farmers have one or two animals with low productivity. Majority of our small holder dairy farmers are socially and economically backward, many of them illiterate, lacking awareness, having blind faiths and beliefs. The farmers are often beset with lack of water, power, funds and failure of agricultural crops.

Milk quality is a relative term, its perception changing from person to person. To many, it may refer to fat content as it is believed that thicker the milk better it is. However, a microbiologist would totally disagree if the bacterial load of milk is in millions, whatever is the fat content. But, a two-year-old child may refuse to drink milk if it smells, irrespective whether the fat content is good or the

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bacterial load is negligible. In India milk can be categorized based on SCC of milk as below. SCC not exceeding 0.2 million is of very good quality, SCC between 0.2 million and 1 million is of good quality, SCC between 1 million and 5 millions is of fair quality and SCC above 5 million is of poor quality (Foster *et al.,* 1979). Teat disinfection is helpful in prevention of disease and also reducing microbial load in the raw milk produced at farm level (Pavicic *et al.,* 2008*)*. Therefore, to be able to produce milk of acceptable parameters, it is necessary to attend these issues from the farm or village level where milk is produced. Washing and disinfection of udder and milkers' hands, and sanitary rinse of milking pails just before milking significantly improved initial bacterial quality of milk (Islam *et al.,* 2009). For upgrading the quality of milk products, one has to start from raw milk received in dairy plant. Pre-milking teat sanitation reduced the intake of *Bacillus spp*. and *S. epidermidis* at the cluster, and reduced the colonisation of milking plants by *Micrococcus*, *Microbacterium, Leuconostoc*, non-*mastitis Streptococci, coryneforms and S. epidermidis* (Anonymous 2002*).* Clean milk production is the latest concept in this direction in India.

The present study entitled "Developing a Hygiene Value Proposition for Deosan Farm Hygiene Product Portfolio" was carried out as a part of MBA (International Agribusiness) final project work spread over a duration of six months, under the affiliation of International Agribusiness Management Institute (IABMI), Anand Agricultural University (AAU), Anand at Chitale Dairy Farm, Sangli (Maharashtra) for Sealed Air Corporation. Looking into all the above aspects, the present study was carried out with the following objectives:

- To observe and monitor the key metrics pre and post implementation of Diversey's Deosan farm hygiene product portfolio for Udder Hygiene and Equipment hygiene programe at Chitale dairy farm.
- To identify and quantify the benefits to the customer after implementation of Deosan farm hygiene product portfolio of Diversey™ at Chitale Dairy Farm and generate a comprehensive report with Value propositions.

Materials and Methods

The study was conducted at Chitale Dairy Farm, Bilawadi Station, Dist. Sangli, Taluka Palus (Maharashtra). Chitale Dairy farm has Asia's Ultra Modern Buffalo Research & Development farm, Nursery for Calf Breeding, Frozen Semen Laboratory, Blood Profile & Pathogenic Laboratory and automatic feeding stations. Primary data were collected from the experiment in Chitale Dairy Farm. Secondary data were collected from magazines, books and internet sources. 104 milking animals (77 buffaloes and 27 cows) at Chitale Dairy Farm were selected for the study. Other experimental unit was milking parlor of Chitale Dairy Farm which has a capacity to milk 10 animals at a time. Milking parlor includes cluster, cluster cups, waiting balls, Clean in Place (CIP) system connected to BMT and BMT. There was constant observation from 15 days prior to commencement of the experiment. During this period samples were taken from the experimental units to measure the pre-treatment counts. Samples including freshwater sample for TVC and colliform count, Rinse Water Sample for TVC and colliform count, BMT Milk for TVC and SCC, Cluster cups swab for TVC at each alternate day. Teat swabs were taken from milking animals to know TVC of teat surface thrice during 15 days.

After pre-treatment examination Deosan farm hygiene product portfolio was implemented in the farm for one month. Hygiene programme includes following steps. Water which was used for the cleaning of the udder was disinfected by 0.25% Superlodip (Iodophor based solution) and personal hygiene routine was implemented which include hand sanitization with Softcare DES-E (alcohol based product). Then during milking after each batch (Cows and Buffaloes) milking clusters were disinfected by 0.2% Divosan Active (peracetic acid solution) to prevent the spread of the contagious disease from one group to another. Post milking teat dip to each milked animal routine was implemented by using 3.33% Superiodip Teat Dip solution. CIP program with 1% Divosan TC-86 (Chlorinated Alkali based detergent) in morning and with 1% Acidbrite 9 (defoamed phosphoric acid based liquid detergent) in evening was implemented. BMT was washed with 0.4% SU-321(Detergent

for open plant cleaning application). No rinse disinfection step post CIP in Milking parlor and BMT was implemented with 0.1% Divosan Active in morning and evening. After completion of one month of implementation of Deosan product portfolio, same samples which were taken for pre-treatment examination were collected from the experimental units for next 15days to measure the post-treatment counts. Treatment was continued in sample collection

Fig. 1. Application of teat dip

period also. The samples were processed and tested in the scientific laboratory of Chitale dairy farm following FSSAI standard for sample processing. Tests used for analysis are Standard Plate Count Test done for TVC and result shown in CFU/ml sample (Colony Forming Unit per milliliter sample) for water, Rinse water sample and Milk Sample. Direct Microscopic Count done for SCC from Milk (SCC/ml milk). Surface Swab Test done for TVC from Cluster Cup and Teat swab result shown as CFU/cm^2. Presumptive colliform count test for Colliform count was done and result shown as MPN/100ml sample (Most Probable number per 100ml) in Water and Rinse water sample. The data generated from the study were analyzed by, Descriptive statistics, Tabular analysis, Paired T-Test and Unpaired T-Test with using MS Excel (Version 2007) and SPSS (Version 16.00).

Results and Discussion

This study was undertaken to see the effects of Deosan Dairy Farm Hygiene Product Portfolio's result at Chitale Dairy Farm. Dairy farm hygiene includes personal hygiene, teat dip, cluster disinfection, CIP rinse and BMT wash. The results obtained are presented below.

a. ***Physical score of milking parlor***

Physical score of the milking parlor was given on the basis of cleanliness of the parlor (Fig. 3). It was scaled as 1 as poor, 2 as fair and 3 as good. Initially there was poor cleaning condition of the milking parlor. Initially there were lots of depositions in the waiting ball, cluster cups and pipes joined to BMT and that was the potential source of microbial contamination.

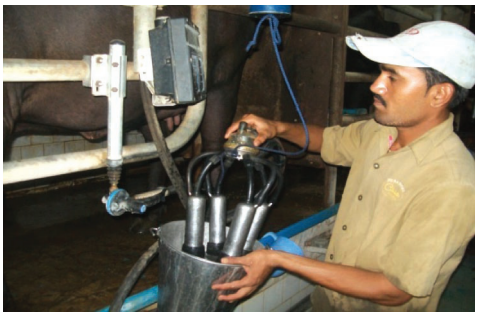
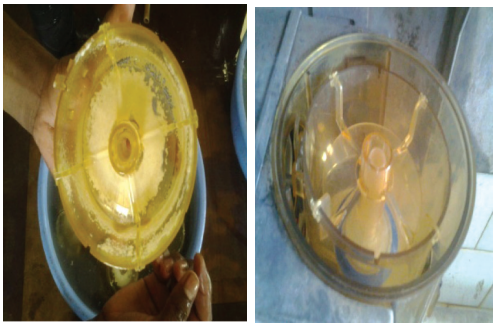


Fig. 2. Cluster disinfection

Table 1. Physical score of milking parlor

Component	Before	After
Milking clusters	1	3
Cluster Cups	1	3
Waiting Ball	1	3
Milk Pipes	1	3
Bulk Milk Tank	1	3

Before **After**



Note: Score: 1- Poor, 2- Fair, 3- Good

Fig. 3. Comparison of waiting ball cleanliness before and after treatment

Table 2. Paired T Test (Descriptive statistics of BMT Milk TVC (CFU/ml)

Paired Samples Statistics					
		Mean(Million)	N	Std. Deviation	Std. Error Mean
Pair 1	BMT TVC Before	27.1905	21	9.15761	1.99836
	BMT TVC After	0.8338	21	0.07131	0.01556

Table 3. Result of Paired T Test for BMT Milk TVC (CFU/ml)

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	BMT TVC Before - BMT TVC After	26.3567	9.17096	2.00127	22.18210	30.53124	13.170	20	.000

The chemicals they were using for CIP rinse were not much effective. During implementation, Deosan range of products was used. Especially in the morning CIP, Divosan TC 86 which is chlorinated detergent was used and in the evening Acidbrite 9 (Phosphoric acid based detergent) was used. So this combination is very much important for proper washing of the CIP system. After implementation of the project there was a visible difference in the physical cleaning of the system. So through use of Deosan range of the product milking parlor cleanliness was improved.

B. Microbial Score of Milk and Milking parlor

B.1 Change in BMT Milk TVC due to treatment

There was a significant decrease (96.94%) in the mean of post treatment TVC of BMT Milk compared to that of the pre treatment TVC of BMT Milk. This difference is mainly due to the hygiene protocols implemented at the Chitale dairy farm. All the chemicals are effective and very much essential in dairy farm hygiene. After implementation of Deosan Product Portfolio there was a significant improvement in the cleanliness of the milking parlor. So through use of the Deosan products, along with physical cleanliness, microbial quality of the milk also improved. Improvement in microbial quality of milk is due to overall implementation of the project including personal hygiene, Udder wash with treated water, Teat dips, Cluster disinfection, CIP wash, BMT wash with range of Deosan Dairy Farm Hygiene Product Portfolio.

Table 2. Paired T- Test [Descriptive Statistics of BMT Milk TVC (CFU/ml)]

Above tables show that a paired samples t-test was conducted to evaluate the impact of treatment on BMT Milk TVC. There was a statistically significant decrease in Post treatment BMT Milk TVC from Pre Treatment BMT milk TVC. (Mean= 27.19 million CFU/ml, SD=9.16) to treated (mean= 0.83 million CFU/ml, SD. 0.071), t (d.f) = 20, $p<0.005$ (two tailed). The mean decrease in parameter was 26.36 million CFU/ ml, with a 95% confidence interval ranging from 22.18 million CFU/ ml to 30.53 million CFU/ ml. There is a significant reduction in the post treatment BMT Milk TVC compared to that of pre treatment.

B.2 Effect of treatment on fresh water TVC

Table 4. Paired T-test [Descriptive Statistics of Fresh Water TVC (CFU/ml)]

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Water TVC Before	65.9048	21	14.05313	3.06664
	Water TVC After	7.0952	21	3.79348	0.82780

Table 5. Results of Paired T-test for Fresh Water TVC (CFU/ml)

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair1	Water TVC Before- Water TVC After	58.8095	14.29202	3.11877	52.30387	65.31517	18.857	20	.000

Above tables show that a paired samples t-test was conducted to evaluate the impact of treatment on Fresh water TVC. Water was treated with 0.25% Superiodipe solution separately in both the shifts. There was a statistically significant decrease in post treatment Fresh Water TVC from Pre Treatment Fresh Water TVC. (Mean= 65.90 CFU/ml, SD=14.05) to treated (mean= 7.09 CFU/ml, SD. 3.79), t (d.f) = 20, p<0.005 (two tailed). The mean decrease in parameter was 58.80 CFU/ml with a 95% confidence interval ranging from 52.30 CFU/ml to 65.31 CFU/ml. There is a significant reduction in the post treatment Fresh Water TVC compared to that of pre treatment.

B.3 Effect of treatment on rinse water

Microbial load in the Rinse water was reduced by 99.99% in the post treatment samples compared to non treated samples. It showed that through use of the Deosan product range the CIP system was cleaned properly and during rinse the chemicals used were much effective. In third rinse also Divosan Active was used as no rinse solution. Ultimately both the chemicals are very much effective and reducing the TVC in rinse water. So there is marked reduction in the source of contamination after milking and the CIP system remain clean.

Table 6. Paired T-Test [Descriptive Statistics of Rinse Water TVC (CFU/ml)]

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Rinse Water TVC Before	403380.1	21	174160	38004.9167
	Rinse Water TVC After	14.3810	21	6.15204	1.34249

Table 7. Results of Paired T test for Rinse Water TVC (CFU/ml)

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Rinse Water TVC Before – Rinse Water TVC After	403367	174157	38004.23	324091	482642	10.614	20	.000

Above tables show that a paired samples t-test was conducted to evaluate the impact of treatment on Rinse water TVC. There was a statistically significant decrease in Post treatment Rinse Water TVC from Pre Treatment Rinse Water TVC. (Mean= 403380.95 CFU/ml, SD= 174160) to treated (mean= 14.38 CFU/ml, SD= 6.15), t (d.f) = 20, p<0.005 (two tailed). The

mean decrease in parameter was 403367 CFU/ml with a 95% confidence interval ranging from 324091 CFU/ml to 482642 CFU/ml. There is a significant reduction in the post treatment Fresh Water TVC compared to that of pre treatment.

B.4 Comparison of coliform count in fresh water and rinse water before and after treatment

Water is an important source of contamination for milk. Use of Deosan products improves milk quality by reducing microbial load of water.

B.5 Change in TVC count of cluster cups after treatment

Due to treatment given such as cluster dipping after milking each lot in Divosan active and CIP rinse with Divosan TC-86, Acidbrite and Divosan active during project implementation there was a marked reduction in cluster cup TVC by 99.63%. The Deosan Products are very much effective and by use of these products the microbial count reduces. Initially there was soil deposition on the cluster cups even after final rinse but after use of Deosan products the soil deposition was reduced and so also the bacterial count.

Table 8. Fresh water and rinse water colliform count change after treatment (MPN/100ml)

Sample	Fresh water		Rinse water	
Time of sample taken	Before Treatment	After Treatment	Before Treatment	After Treatment
Coliform count (MPN/100 ml) (Mean of results)	16	2	16	2

Through implementation of Deosan product portfolio water quality is improving in terms of colliform count. Fresh water used for udder wash was treated with 0.25% Super Iodip. In CIP, chemicals used (Divosan TC-86, Acidbrite), No rinse step done for third rinse of CIP and BMT cleaning with Divosan Active are very effective. Deosan products are reducing coliform counts by 87.5% in both fresh water and rinse water. Water is an important parameter which determines quality of milk.

Table 9. Paired T-Test [Descriptive Statistics of Cluster Cup TVC (CFU/cm^2)]

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Cup TVC Before	207361.90	42	216165	33354.98524
	Cup TVC After	753.38	42	288.28153	44.48281

Table 10. Results of Paired T test for Cluster Cup TVC (CFU/cm^2)

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Cup TVC Before – Cup TVC After	206609	216053	33337.717	1.39282	2.73935	6.197	41	.000

Above tables show that a paired samples t-test was conducted to evaluate the impact of treatment on Cluster cup TVC. There was a statistically significant decrease in Post treatment Cluster cup TVC from Pre Treatment Cluster cup TVC. (Mean= 207361.90 CFU/cm^2, SD= 216165.01) to treated (mean= 753.381 CFU/cm^2, SD= 288.281), t (d.f) = 41, $p<0.005$(two tailed). The mean decrease in parameter was 206609 CFU/cm^2 with a 95% confidence interval ranging from 139282 CFU/cm^2 to 273935 CFU/cm^2. There is a significant reduction in the post treatment Fresh Water TVC compared to that of pre treatment.

B.6 Change in SCC after treatment

SCC in the milk is increasing by

47.37%. Though SCC is increasing (maximum up to 0.13 million), milk can be categorized under very good quality as per quality standard of India by *Foster et al. 1979*. Increasing SCC in milk is a negative parameter but the change may be due to some external factors. Probable reasons for more SCC includes followings. The study was done in extreme summer season. In summer milk output is reduced and due to stress of milk production the SCC per ml of milk is increasing. Extreme summer may be one of the factors which may cause mastitis and increase SCC. Environmental mastitis may also increase somatic cell count. It may be due to existing infections in the herd. Effect of product portfolio on SCC of milk may take more time while the data were recorded for two months only.

Table 11. Paired T-Test [Descriptive Statistics of BMT Milk SCC (SCC/ml)]

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	SCC Before	90986.71	21	31665.68388	6910.01873
	SCC After	134088.09	21	28251.52609	6164.98842

Table 12. Results of Paired T test for Rinse BMT Milk SCC (SCC/ml)

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	SCC Before – SCC After	-43102.4	40444.42	8825.69	-61512.46	-24692.30	-4.88	20	.000

Above tables show that a paired samples t-test was conducted to evaluate the impact of treatment on BMT SCC. There was a statistically significant increase in Post treatment BMT SCC from Pre Treatment BMT SCC. (Mean= 90985.71 SCC/ml, SD= 31665.68) to treated (mean=134088.09 SCC/ml, SD= 28251.52), t (d.f) = 20, p<0.005(two tailed). The mean increase in parameter was 43102.4 SCC/ml with a 95% confidence interval ranging from 61512.46 SCC/ml to 24692.30 SCC/ml. There is a significant increment in the post treatment BMT SCC compared to that of pre treatment.

B.7 Change in teat swab TVC

Teat surface swab TVC is markedly reduced by 93.55% after the treatment protocol implementation. Initially there was no treatment given to the teat but during the project implementation udder was washed with iodine treated water and post milking iodine based teat dip was given. So, ultimately physical condition of the teat was improved. Whole teat surface was sanitized with chemicals and due to that microbial load on the teat surface was reduced thus it helps in improvement in microbial quality of milk.

Table 13. Independent T-Test [Descriptive Statistics of Teat swab TVC (CFU/cm^2)]

Group Statistics					
	Before-After	N	Mean	Std. Deviation	Std. Error Mean
Teat Swab TVC	Before	18	324861.11	182143	42931.466
	After	18	20926.66	2119.080	499.472

Table 14. Results of Independent T-test for Teat swab TVC (CFU/cm^2)

Independent Samples Test										
		Levene's Test for Equality of Variance		T-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Teat Swab TVC Before	Equal variances assumed	13.387	.001	7.079	34	.000	303934	42934.371	216681	391188
	Equal variances not assumed			7.079	17	.000	303934	42934.371	213353	394516

An independent samples T test was conducted to compare Teat surface swab TVC before and after treatment. There was a significant difference in Teat swab TVC before treatment (Mean =324861.1111 CFU/cm^2, SD 182142.7854) & after treatment (mean=20926.6667 CFU/cm^2, SD 2119.08038); t(d.f.) = 17, P<.005 (Two tailed). The magnitude of the difference in the mean was 303934.45 CFU/cm^2 with a 95% Confidence interval ranging from 216681 CFU/cm^2 to 213353 CFU/cm^2.

It can be concluded that Deosan Dairy Farm hygiene product portfolio provides wide range of chemicals and solutions which are helpful in dairy farm hygiene. In India, products of Deosan can be used in large commercial dairy farms as well as at small farmer level also. Through use of Deosan Dairy Farm hygiene products new concept of Clean Milk Production can be fulfilled and the quality of raw milk in India can be improved. BMT milk Microbial load was reduced by 96.94%. Other components of milking parlor showed improvement in terms of Physical cleaning. Fresh water TVC was reduced by 89.23% when treated with 0.25% Super iodip solution. Coliform count of water was also reduced by 87.5%. CIP system was washed by 1% Divosan TC-86 in the morning and 1% Acidbrite-9 in the evening. TVC of rinse water was reduced by 99.99%. Coliform count was also reduced by 87.5%. TVC of Cluster cup was reduced by 99.63%. Teat Dip is an important preventive measure to reduce number of mastitis incidence in the farm. Through use of udder wash and Teat dip, teat surface swab had shown improvement in the bacterial count by 93.55%. So the initial source of the contamination was reduced. It has impact on the udder health and it may prevent mastitis incidence and that's why it is economically very useful for a dairy farmer. Somatic Cell Count (SCC) is an important parameter in terms of quality of milk and also shows udder health. During this project SCC was increased but it was not due to treatment given in the farm. It may be due to some environmental effect which may cause mastitis and heat stress on the animals which lower down milk output. SCC will be reduced after prolonged use of the teat dip which may lower down mastitis incidence in the farm. It may take more time to reduce SCC in milk and the project implementation was for limited period only. Government and dairy cooperatives can be convinced to give higher prices for milk with good quality parameters. SUMUL Dairy of Gujarat is giving higher price of milk with low bacterial count (*Sumul Dairy website, 2013*).

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