

Effect of rubber mats on comfort of dairy animals

■ S.K. JAIN, D.M. MAHALE AND N.J. THAKOR

Received : 26.07.2013; Revised : 13.10.2013; Accepted : 14.11.2013

See end of the Paper for authors' affiliation

Correspondence to :

S.K. JAIN

Department of Farm Structures,
College of Agricultural
Engineering and Technology, Dr.
B.S. Konkan Krishi Vidyapeeth,
Dapoli, RATNAGIRI (M.S.)
INDIA
Email : jsandeep1967@gmail.com

■ **ABSTRACT** : In the hot and humid climate of Konkan region issue of cow comfort is ignored and hence has serious implications for barn profitability. Twelve cows were selected for study of comfort on concrete floor and rubber mat floor. The average lying down time of cows was increased on rubber mat floor from 2.00 to 4.28 h. The time required to sit and to stand the cow on rubber mat floor was less as compared to concrete floor. The average maximum number of slippage on concrete floor was observed 4.9 and on the rubber mat floor was 4.0. The average minimum number of slippage on concrete floor was 4.4 and on the rubber mat floor was 2.6. The milk production was increased by 30.4 per cent when cows were housed on rubber mat floor as compare to concrete floor due to increase in comfort.

■ **KEY WORDS** : Rubber mat floor, Concrete floor, Slippages, Time to sit and to stand, Milk production

■ **HOW TO CITE THIS PAPER** : Jain, S.K., Mahale, D.M. and Thakor, N.J. (2013). Effect of rubber mats on comfort of dairy animals. *Internat. J. Agric. Engg.*, 6(2) : 463-468.

The state of Maharashtra has maximum area under rainfed even though it is one of the leading state in terms of livestock population and milk production in the country. In the year 2010-11, milk production in Maharashtra state was 8.0 million tones and per capita milk availability was 196 g while at national level milk production was 121.8 million tones and per capita milk availability was 281 g. In the different regions of Maharashtra, Vidarbha region depicted maximum contribution of local cows (37%) and minimum in Konkan (9%). The negative growth rate in population of local cows was observed from -1.14 in 1992-97 to -5.75 per annum during 2003-07. The positive growth in cross bred cows was observed in all regions of Maharashtra except in Konkan (-5.345) (Nagrle *et al.*, 2012).

Konkan region is high rainfall (>3500 mm) area with hot and humid climate. In Konkan region cows are tied in dairy barns for more than 16 hours. Due to hard concrete floor or laterite stone floor the cows are reluctant to lie down. It is fact that more lying down time leads to proper blood circulation in udder and consequently more milk production. Cows like to lie down on soft beddings. Krohn and Munksgurad (1993) reported that more time in a day cow lying on the rubber mat as compared to the concrete flooring. Cow lying on the rubber mat was 13 hours per day. Cow feels comfort when lying on rubber mat. Tyson and Graves (2001) studied that rubber mats to cover the floor surface could relived some of stress on cow feet and legs. Rubber flooring

should also be grooved to provide confident footing. Daniel (2000) stated that cows were more likely to spend time lying down on comfort mat than on the rubber and they were more likely to use the rubber than the concrete. Manninen *et al.*, (2002) reported that when giving a free choice between different bedding materials, cows avoided sand, preferring both straw and soft rubber mats, both in winter and summer. Gudaj (2009) studied that due to the rubber flooring cows were more excited and motivated to fill barn stall quicker. Thus, by using the rubber mat there is benefit in saving time and giving relief to cows hooves without compromising animal welfare. McFarland (2010) reported that the cows liked to rest in concrete base free stalls with a relatively thin layer of sand bedding or rubber flooring. This material helps in the cooling through respiration and sweating.

Therefore, study was undertaken with objective to determine the lying down time and milk production of cows when housed on concrete floored and rubber mat floored barn.

■ METHODOLOGY

The study was conducted in a concrete floored dairy barn of size 18 m x 10 m suitable for housing 30 cows. The cows were housed on the rubber mats of size 1524 mm (L), 1060 mm (W), and 15 mm (T) made of material vinyl ethyl methyl acetate. The rubber mats have parallelogram shaped grooves of size 5 mm x 5 mm. The 10 to 12 cows were

selected by considering their lactation period for study.

The body weight of cows was computed by Shuffler's formula. According to body weight the diet of cows was fixed and kept constant during the study. A CCTV camera and DVR box was used to record lying down time of cows, time required to sit, time required to stand by the cows, number of slippages of cows on concrete floor and rubber mat floor. The rectal temperature, pulse rate and respiration rate of cows were measured in the barn. The climatic parameters *viz.*, ambient temperature and relative humidity were recorded during study. The study was replicated for ten (10) 24 hours cycle. The results of camera were analysed by the same person and on the same computer. The cleanliness and hygienic conditions were observed on concrete floor and rubber mat floor by following a scorecard developed by Chiappini and Jenni (2010).

RESULTS AND DISCUSSION

The results of the present study as well as relevant

discussions have been presented under following sub heads:

Lying down time of cows:

The body weight of cows is shown in Table 1. The observations of lying down time of cows housed on concrete floor and rubber mat floor are shown in Table 2 to 4. The cows were housed on the concrete floor and rubber mats, the behavior and lying down time of cows was recorded. When housed on the concrete floor, it was observed that cows spend a lot of time in standing idly. This could be an indicator of stall conditions that are deterring cows from lying. But when cow housed on rubber mats, it was observed that cows spend more time lying on rubber mats. It was also observed that after evening milking, cows on concrete floor start lying after 1 h and on rubber mats start lying instantly after milking. The lying down period was less on concrete floor as compared to rubber mat floor. Average difference between lying down time of cows housed on concrete floor and rubber mats is shown in Table 4.

Table 1 : Body weights of cows

Sr. No.	Cow name	Length, inch (cm)	Chest girth, inch (cm)	Body weight of cow (kg)
1.	M-218	76.65 (195)	53.54 (137)	332
2.	M-224	78.26 (199)	62.40 (159)	460
3.	Local-4	80.31 (205)	64.56 (165)	506
4.	Ranjita	78.34 (199)	66.14 (167)	518
5.	Anandi	81.88 (208)	67.32 (170)	561
6.	M-189	76.77 (194)	61.81 (157)	444
7.	Avantika	80.70 (205)	63.38 (160)	490
8.	Madhura	78.56 (200)	64.37 (164)	492
9.	Damini	79.13 (201)	69.68 (177)	581
10.	Payal	79.92 (203)	67.51 (170)	551
11.	Alka	79.13 (201)	67.32 (170)	542
12.	Kanchan	80.70 (205)	68.89 (175)	579

Table 2 : Lying down time of cows on concrete floor

Sr. No.	Name of cow	Lying down time of cows on concrete floor in hours										Avg.
		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	
1.	M-218	10.53	11.96	10.28	10.71	09.88	11.43	10.58	10.18	11.73	10.81	10.89
2.	M-224	13.72	12.82	11.6	15.35	10.78	12.65	11.32	14.9	10.63	13.45	12.72
3.	L-4	12.53	10.62	12.97	13.57	10.35	14.88	12.1	14.28	14.45	12.63	12.83
4.	Ranjita	13.31	11.68	13.4	14.48	9.6	12.8	10.51	13.13	13.88	12.68	12.54
5.	Anandi	13.58	12.3	11.78	14.95	10.38	13.65	10.96	13.43	14.81	13.06	12.89
6.	M-189	12.78	13.85	12.71	11.71	12.9	10.63	11.15	10.61	12.43	10.95	11.97
7.	Avantika	11.33	11.3	11.8	10.66	11.21	10.11	9.6	7.23	10.81	10.35	10.44
8.	Madhura	10.43	12.6	10.35	11.38	10.48	9.66	10.73	7.66	10.63	10.88	10.48
9.	Damini	12.63	13.08	12.35	11.8	12.51	10.63	11.15	7.73	12.43	10.95	11.52
10.	Payal	13.25	13.08	13.66	12.52	13.11	11.49	10.53	8.37	13.08	12.41	12.15
11.	Alka	10.12	12.44	10.03	10.63	11.58	10.85	11.78	7.45	12.1	10.63	10.80
12.	Kanchan	13.38	13.08	12.366	12.63	11.86	11.55	10.25	9.73	12.58	11.76	12.72

The Table 4 showed that the cows were lying more time on rubber mat floor. The increase in lying down time of cows was in the range of 2.0 h to 4.28 h. It showed that as per lying down time cows were more comfortable on rubber mat as compared to concrete floor. Statistically, the lying down time for cows housed concrete floor and rubber mats were significantly different.

Time required to sit and to stand the cows housed on concrete floor and rubber mat floor :

It is clear from Table 5 that time required to sit the cow on concrete floor was more as compared to rubber mat floor. The maximum time required to sit the cows on concrete floor was 4.91 seconds and on the rubber mat floor was 3.82 seconds. The minimum time required to sit the cows on concrete floor was 4.57 seconds and on the rubber mat floor was 3.62 seconds. The maximum time required to stand the cows on concrete floor was 5.2 seconds and on the rubber

mat floor was 3.62 seconds.

It is clear from Table 6 the minimum time required to stand the cows on concrete floor was 4.55 seconds and on the rubber mat floor was 3.3 seconds. Average difference between times required to sit and to stand the cows when housed on concrete floor and rubber mats floor were 1.03 and 1.32 seconds. When the cows were housed on the concrete floor, it was observed that cows required more time to sit and to stand but on the rubber mat floor, it was observed that cows required less time to sit and to stand. It revealed that cows were more comfortable on rubber mat as regards to sit and to stand. Statistically, the observations were found to be significant.

Rectal temperature, pulse rate and respiration rate of cows :

The data were recorded for rectal temperature, pulse rate and respiration rate of cows housed on concrete floor

Sr. No.	Name of cow	Lying down time of cows on rubber mat floor in hours										
		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Avg.
1.	M-218	12.63	14.1	13.48	12.93	11.85	13.1	11.53	12.78	12.63	14.08	12.91
2.	M-224	16.88	14.86	13.76	17.1	12.75	14.46	12.54	16.45	13.56	15.81	14.81
3.	L-4	16.48	13.61	14.43	15.38	12.45	16.38	13.35	15.85	16.13	14.63	14.86
4.	Ranjita	15.26	14.43	15.85	16.85	11.71	14.31	12.71	14.55	15.68	15.43	14.67
5.	Anandi	15.78	15.15	14.08	17.18	12.58	15.45	11.96	15.7	16.1	14.96	14.89
6.	M-189	12.6	14.1	15.3	16.58	12.7	14.75	12.81	15.43	14.61	13.7	14.25
7.	Avantika	14.71	13.96	14.4	14.55	14.51	14.51	12.78	13.7	13.48	13.28	12.66
8.	Madhura	15.48	13.7	15.65	14.95	12.63	15.71	14.1	14.45	15.6	15.41	14.76
9.	Damini	15.61	15.43	14.88	15.88	15.35	14.6	13.9	15.9	14.78	13.61	14.99
10.	Payal	16.88	14.86	13.76	17.1	12.75	14.46	12.68	16.45	13.56	15.81	14.83
11.	Alka	15.06	15.38	14.56	14.46	13.85	15.1	14.58	14.9	15.76	14.45	12.91
12.	Kanchan	15.4	13.81	13.1	15.21	14.8	14.93	14.7	14.28	13.43	15.38	14.81

Sr. No.	Name of cow	Avg. lying down time on concrete in hr	Avg. lying down time on rubber mats in hr	Increases lying down time on rubber mats in hr	Statistically Sig./NS
1.	M-218	10.89	12.91	2.02	Sig.
2.	M-224	12.72	14.81	2.09	Sig.
3.	L-4	12.83	14.86	2.03	Sig.
4.	Ranjita	12.54	14.67	2.13	Sig.
5.	Anandi	12.89	14.89	2	Sig.
6.	M-189	11.97	14.25	2.28	Sig.
7.	Avantika	10.44	12.66	2.22	Sig.
8.	Madhura	10.48	14.76	4.28	Sig.
9.	Damini	11.52	14.99	3.47	Sig.
10.	Payal	12.15	14.83	2.68	Sig.
11.	Alka	10.80	12.91	2.11	Sig.
12.	Kanchan	12.72	14.81	2.09	Sig.

Sig. – Significant; NS – Non significant

and rubber mat floor. It showed that there was maximum difference of 2°C in rectal temperature, 5 pulses per min. in pulse rate and 4 breath per min. in respiration rate of cows housed on concrete floor and rubber mat floor. It revealed from the observed data that on both the floors cows maintain their body temperature. This behavior of cows is called homoeothermic.

Number of slippages of cows :

The data recorded for the number of slippages of cows housed on concrete floor and rubber mat floor are presented in Table 7 and 8. The average maximum number of slippage on concrete floor was observed 4.9 and on the rubber mat floor was 4.0. The average minimum number of slippage on concrete floor was 4.4 and on the rubber mat floor was 2.6. It was observed that the numbers of slippages on concrete

floor are more than the rubber mat floor. This revealed that cows were comfortable on rubber mat floor as regarding slippages. The statistical analysis revealed that the number of slippages of all cows was found to be significant.

Milk production :

The average milk yield of seven cows measured for ten 24 hrs cycle in the year 2010 and of five cows measured in the year 2011 are presented in Table 9. The milk yields were found to be significantly different. Cows have shown the yield more on rubber mats than on concrete floor. The milk yield was observed for whole lactation period of cows. The study was carried out during 7th March, 2012 – 3rd September, 2012. The observations of average milk yield of four (4) cows are presented in Table 10. The milk yield of different cows was increased in the range of 25.750 l to 99.750 l. The

Table 5 : Comparison of time required to sit the cows on concrete floor and rubber mat floor

Sr. No.	Name of cow	Avg. time on concrete in s.	Avg. time on rubber mats in s.	Difference in time s.	Statistically Sig./NS
1.	M-218	4.71	3.8	0.91	Sig.
2.	M-224	4.57	3.76	0.81	Sig.
3.	L-4	4.6	3.81	0.80	Sig.
4.	Ranjita	4.62	3.26	1.36	Sig.
5.	Anandi	4.91	3.76	1.15	Sig.
6.	M-189	4.81	3.76	1.05	Sig.
7.	Avantika	4.87	3.68	1.19	Sig.
8.	Madhura	4.78	3.81	0.97	Sig.
9.	Damini	4.84	3.67	1.17	Sig.
10.	Payal	4.86	3.72	1.14	Sig.
11.	Alka	4.75	3.69	1.06	Sig.
12.	Kanchan	4.67	3.82	0.85	Sig.
	Average	4.7	3.7	1.03	

Sig. – Significant; NS – Non significant

Table 6 : Comparison of time required to stand the cows on concrete floor and rubber mat floor

Sr. No.	Name of cow	Avg. time on concrete in s.	Avg. time on rubber mats in s.	Difference in time in s.	Statistically Sig./NS
1.	M-218	4.99	3.3	1.69	Sig.
2.	M-224	4.55	3.35	1.20	Sig.
3.	L-4	4.58	3.57	1.01	Sig.
4.	Ranjita	4.84	3.57	1.27	Sig.
5.	Anandi	5.2	3.47	1.73	Sig.
6.	M-189	4.9	3.51	1.39	Sig.
7.	Avantika	4.78	3.47	1.31	Sig.
8.	Madhura	4.91	3.62	1.29	Sig.
9.	Damini	4.72	3.59	1.13	Sig.
10.	Payal	4.74	3.51	1.23	Sig.
11.	Alka	4.87	3.54	1.33	Sig.
12.	Kanchan	4.82	3.61	1.21	Sig.
	Average	4.82	3.5	1.32	

Sig. – Significant; NS – Non significant

Table 7 : Number of slippages of cows on concrete floor

So. No.	Name of cow	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Avg.
1.	M-218	6	4	3	5	6	4	4	7	5	3	4.8
2.	M-224	4	5	7	4	4	3	5	4	6	3	4.6
3.	L-4	5	7	3	3	5	3	4	6	4	4	4.4
4.	Ranjita	5	6	3	4	3	5	5	4	6	5	4.5
5.	Anandi	5	5	4	5	3	6	4	5	5	4	4.6
6.	M-189	7	5	4	6	5	3	6	4	4	3	4.8
7.	Avantika	3	4	4	7	5	3	5	4	6	4	4.5
8.	Madhura	6	5	5	6	4	5	3	5	4	5	4.8
9.	Damini	4	5	7	3	4	6	3	7	4	3	4.7
10.	Payal	6	3	5	5	3	6	4	5	3	5	4.4
11.	Alka	5	6	4	3	5	4	4	6	5	4	4.9
12.	Kanchan	3	6	5	7	4	5	5	4	6	5	4.7

Table 8 : Number of slippages of cows on rubber mat floor

So. No.	Name of cow	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Avg.
1.	M-218	2	3	3	4	3	2	3	3	4	3	3.0
2.	M-224	4	4	2	4	5	4	4	2	4	5	3.7
3.	L-4	3	4	3	2	4	3	4	3	2	4	3.1
4.	Ranjita	3	3	4	3	3	3	3	4	3	3	3.2
5.	Anandi	4	5	3	4	4	4	5	3	4	4	4.0
6.	M-189	3	2	2	3	3	3	2	2	3	3	2.6
7.	Avantika	5	4	3	4	3	5	4	3	4	3	3.9
8.	Madhura	4	3	3	3	5	4	3	3	3	5	3.5
9.	Damini	3	3	3	4	2	3	3	3	4	2	3.1
10.	Payal	2	3	4	5	2	2	3	4	5	2	3.3
11.	Alka	3	4	3	4	3	3	4	3	4	3	3.0
12.	Kanchan	2	4	2	3	3	2	4	2	3	3	3.7

Table 9 : Average milk productions of cows

Name of cow	Average milk production, ml				Statistically Sig./NS
	2010		2011		
	Concrete	Rubber mat	Concrete	Rubber mat	
Avantika	3693.3	3869.5	4550.0	5150.0	Sig.
Madhura	-	-	5275.0	5900.0	Sig.
Damini	6726.6	6791.0	3550.0	4850.0	Sig.
Payal	8864.0	9263.0	4725.0	5450.0	Sig.
Kanchan	7719.9	7983.9	3825.0	5100.0	Sig.
Kasturi	9583.0	9733.0	-	-	Sig.
Devki	6007.0	6060.5	-	-	Sig.
Local-2	4358.7	4419.9	-	-	Sig.

Table 10 : Average milk productions of cows (7th March, 2012 to 6th September, 2012)

Cow code	Cow name	Calving date	Milk Production, l		Increase in milk yield, l (%)
			Concrete floor	Rubber mat floor	
M-143	Kasturi	05.10.11	299.500	399.250	99.750 (33.3%)
612	-	04.09.11	095.750	121.500	25.750 (26.9%)
M-155	Kanchan	01.11.11	132.750	227.250	94.500 (71.2%)
M-189	-	04.11.11	421.750	490.500	68.750 (16.3%)
	Total		949.750	1238.500	288.750 (30.4%)

increase in milk yield of all the cows was found in the range of 16.3 per cent to 71.2 per cent. The average increase in milk yield was 30.4 per cent.

Conclusion:

– Lying down time of cows on rubber mats was more as compared to the concrete floor. Thus cows were comfortable on rubber mat floor than concrete floor.

– Time required to sit and to stand by the cows on rubber mat floor was less than the concrete floor, therefore, cows were comfortable on rubber mat floor.

– The numbers of slippages of cows housed on rubber mat floor were less than the concrete floor.

– The milk yield obtained was 30.4 per cent more for the cows when housed on rubber mat than when housed on concrete floor.

Authors' affiliations:

D.M. MAHALE, College of Agricultural Engineering and Technology, Dr. B.S. Konkan Krishi Vidyapeeth, Dapoli, RATNAGIRI (M.S.) INDIA

M.S. POWALE, Department of Agricultural Processing Engineering, College of Agricultural Engineering and Technology, Dr. B.S. Konkan Krishi Vidyapeeth, Dapoli, RATNAGIRI (M.S.) INDIA

■ **REFERENCES**

Daniel, L. (2000). The use of getting up and lying down movement of cow. *Vet. Res. Common.*, **13**: 307-324.

Gudaj, R. (2009). The behavior of cows in response to rubber mats in milking parlour stalls. *Animal Welfare, Etiology & Housing Systems*, **5**(3): 231-253.

Krohn, C.C. and Munksgard, L. (1993). Behavior of dairy cows kept in extensive (loose housing pasture) or intensive (tie stall) environments. II. Lying and lying-down behaviour. *Appl. Animal Behavior Sci.*, **37** (1) : 1-16.

Mannien, E., Passille, A.M., Rushen, J., Norring, M. and Saloniemi, H. (2002). Preferences of dairy cows kept in unheated building for different kind of cubical flooring. *Appl. Ani. Behaviour Sci.*, **74**(4): 281-292

McFarland, Dan F. (2010). M.S.-Sr.Extension Educator Agricultural Engineering Penn State Cooperative Extension. Dairy Facility Design and Management Factors That May Cause or Contribute To Lameness. Penn State Dairy Cattle Nutrition Workshop 63-71.

Nagrle, B.G., Datta, K.K. and Ghule, A.K. (2012). Regional trends and pattern in milk production in Maharashtra State. *Indian J. Dairy Sci.*, **65**(5):410-415.

Tyson, T. J. and Graves, E.R. (2001). Designing and building dairy cattle free stalls. Agricultural and Biological Engineering. College of Agricultural Sciences, Penn State. G-76: 5.

★★★★★ of Excellence ★★★★★
6th Year