



*Original Research*

## Effects of Rubber Mat Flooring on Behaviours, Welfare and Production Performance in Crossbred Cows

K. H. Sadharakiya and L. M. Sorathiya\*

Department of LPM, Vanbandhu College of Veterinary Science and Animal Husbandry, Navsari Agricultural University, Navsari-396 450, Gujarat, INDIA

\*Corresponding author: [lmsorathiya@yahoo.co.in](mailto:lmsorathiya@yahoo.co.in)

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### Abstract

The present study was conducted on 18 lactating crossbred cows by dividing them into two homogeneous groups randomly. The cows of treatment group were kept in shed having rubber mat flooring whereas the cows of control were kept on concrete floor. The objective was to study the effect of rubber mat flooring on behaviours (sitting time, standing time and rumination time), preference for lying, slipping incidence and milk production and quality. Overall sitting time (minutes) was significantly ( $p < 0.01$ ) higher in cows of rubber mat (581.90) than concrete group (557.60). Overall rumination time (minutes) was significantly ( $p < 0.01$ ) higher in cows kept on rubber mat flooring (522.10) than concrete flooring (435.30). The effect of flooring on standing/lying preference within rubber mat group showed that when choice of flooring material provided to cows overall standing time (minutes) on rubber mat (196.48) was significantly higher than concrete surface (150.05). Similarly, overall sitting time (minutes) in cows of rubber mat was significantly higher (431.76 v/s 150.14). Rumination time was significantly ( $p < 0.01$ ) higher in rubber mat group. Total 73.04 and 64.52% cows preferred to stand or lie on rubber mat, respectively when given free choice to cows. The slipping incidences was lower (31.74%) in cow kept on rubber mat flooring than concrete flooring (74.60%). The average mean milk yield (litre/day) of crossbred cows was  $8.31 \pm 1.00$  and  $8.51 \pm 0.76$  on rubber mat and concrete floor, respectively which was non-significant. The mean somatic cell count in cross bred cows across both groups ( $165454.38 \pm 4743.17$  v/s  $190201.83 \pm 6224.63$  no. of cells/ml in rubber mat and concrete, respectively) were statistical significant ( $p < 0.01$ ).

**Key words:** Behaviour, Crossbred Cow, Milk, Rubber Mat, Somatic Cell, Welfare

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### Introduction

As per 19th livestock census, crossbred cows population in India population increased rapidly during inter-sensual period from 2007 to 2012@ 20.18% (Anon, 2012). Although the crossbred cows are better milk



producer, efficient feed convertor and more docile, they are more susceptible to climatic stress and diseases. So they need better care in comfortable housing with soft flooring. Soft walking surfaces such as solid rubber flooring have become increasingly popular alternatives to hard floors in the walking area of dairy facilities. A soft floor may reduce the pressure on the foot (Nuss *et al.*, 2015) and potentially improve cow comfort and it may reduce the incidence of lameness. Most of dairy farmers in India prefer concrete floor to house crossbred cows as it can be easily cleaned and durable. However, concrete cannot provide comfort necessities for standing, walking and lying. It is not the ideal walking and standing surface for cow because of its abrasive and hard nature (Phillips and Morris, 2001). Another serious objection includes slipperiness as it doesn't provide enough friction for natural locomotion and standing. Discomfort to dairy cow due to hard flooring can reduce the lying time. Nowadays provision of cushioned flooring particularly rubber mat in the animal house is gaining popularity. Providing soft rubber floor and sand bedding is found favourable for cow comfort, health, hygiene and milk production. Cows provided with a softer bed are known to stand up and lie down twice as often as cows on concrete (Chapinal *et al.*, 2009). As per the findings of Venegas *et al.* (2006) cows on rubber flooring had decreased claw growth and wear between the first and last examination compared with cows on concrete. Housing the cows in large pens with mattress flooring increased lying time by 4 hours per day compared to housing them in tie stalls with concrete flooring (Haley *et al.*, 2001). A lame cow will not only drop in milk yield during the illness, but also months before and after (Green *et al.*, 2002). Thus, poor flooring has an indirect effect on milk yield by causing lameness and claw disease. Out of available options for flooring, rubber mat is cheaper, long lasting and available in local market with practically zero maintenance. Still the usefulness of rubber mat is not well studied with respect to crossbred cow's physiological responses, behaviour and performance. Therefore, present study was conducted to study effects of rubber mat flooring on sitting, lying and rumination behaviors in lactating crossbred dairy cows.

### Materials and Methods

The present study was conducted at Livestock Research Station, Navsari Agricultural University, Navsari, Gujarat state, India during 10<sup>th</sup> October 2017 to 20<sup>th</sup> January 2018 for 90 days. Eighteen lactating H. F. X Kankrej crossbred cows of mixed parity were randomly divided into two homogeneous groups based on milk production and date of calving. One group was kept on rubber mat (RM) while other was on concrete floor (CON). The Rubber mat used in experiment was 16 mm thick, 6'×4' in size and had 40 kg weight. Total 20 mats were placed in one pen. Roughly half of the floor area in treatment pen was covered by the rubber mat adjacent to manger and remaining area was concrete. It was conducted in two identical pens in semi-loose, head to head and *pakka* shed. The dimension of one pen was 12 X 16 meters in which half of area was under asbestos roof whereas half of the area was open. The shed was enclosed by 1.5 meters high

wall with two gates one on eastern and another on western side. The whole area in shed had *pakka* concrete floor. Feed offered in both treatments were similar throughout the experiment. Jowar (*Sorghum bicolor*) hay and paddy (*Oryza sativa*) straw were fed as dry fodder. Hybrid Napier grass, jowar, lucerne and maize was green fodders used to fed cows during experimental period. Dry and green fodders were chaffed together were fed thrice a day to all cows *i.e.* 10 am, 3 pm and 9 pm throughout the experimental period. Cows were milked twice a day at morning (3:30 am) and evening (3.30 pm) in milking parlour. The experimental shed was cleaned manually every day and also by forced water spray using jet pump once in week. Lying and rumination behaviours of all cows were observed visually for 24 hours except feeding, milking and drinking time at fortnight interval and overall mean was calculated. It was studied manually by selecting two cows at a time from each group. All the cows, one by one were observed in same way. Further, preference for lying and standing on rubber mat was studied in RM group only by observing frequency of cows either sitting or standing on rubber mat or concrete floor at hourly interval. Slipping incidence during 24 hours was observed once in month by counting number of slips by visualization. Daily milk yield was recorded and average daily milk yield (l/d) was worked out of cows of both group. The somatic cell count (SCC) was determined as per the standard protocol (Schalm *et al.*, 1971) in order to judge milk quality. For this purpose 10 µl milk sample was spread over 1 cm<sup>2</sup> marked square area on glass slide. It was left at room temperature for drying. Then it was fixed in methanol for 5 minutes. After drying it was stained by Newman- Lampert stain for 2 minutes and dried at room temperature, then washed in tap water three times and distilled water two times before a final drying at room temperature (Marshall, 1992). Somatic cells were counted through 1000 X magnification using oil immersion and were calculated as follow: as 0.01 ml (10µl) of milk was spread in 1 cm<sup>2</sup>, possible number of such fields which could be counted in 1 cm<sup>2</sup> was 3181.82. Milk volume represented by each field was = 1/100 X 1/3181.82. Hence microscopic field was (MF) was 318182. Total no. of field counted was 50. Working factor (WF) was = 3181.82/50 = 6363.63. The SCC/ml of milk= 6363.63 x Number of cell counted (in 50 fields). The tabulated data were analyzed by various suitable techniques in IBM® SPSS® Statistics Version 20.0. Statistical significance between two treatments was analyzed by t test. The collected data were counted in terms of frequency followed by its conversion into percentage as per standard statistical method (Snedecor and Cochran, 1989).

## Results and Discussion

The effect of flooring types on mean time spent in standing, sitting and rumination is presented in Table 1. Results revealed that the overall mean standing time (minutes) on RM (346.52±6.36) and CON (335.33±3.71) was non-significant. Overall sitting time was significantly ( $p < 0.01$ ) higher in cows kept on rubber mat flooring (581.90±4.72) than the cow kept on concrete flooring (557.60±6.65).

**Table 1:** Effect of flooring types on lying and rumination time (minutes) in crossbred cows

Behaviours	RM	CON	t Value	p value
	Mean±S.E.	Mean±S.E.		
Standing	346.52±6.36	335.33±3.71	1.52	0.131
Sitting	581.90±4.72	557.60±6.65	2.98	0.003
Rumination	522.10±4.45	435.30±3.21	15.815	0

When cows were provided rubber mat flooring the mean sitting time was higher in RM group as compare to CON group (Haley *et al.*, 2000; Haley *et al.*, 2001; Schutz and Cox, 2014 and Bhamare, 2017). All the said studies revealed 1.5 to 4 hours more sitting time in cows housed on rubber mat or similar soft flooring materials which is quite higher than sitting time observed (about 24 minutes more) on RM in present experiment. Less sitting time as compared to other said study might be due to use of medium thick (16 mm) rubber mat in 50% of floor area. Further, 9 cows were housed in loose pen, so, they had equal chance for lying either on CON or RM might be associated with less lying time than said studies. Schutz and Cox (2014) revealed that the lying time of cow on wood chips: 10.8 h, 24-mm rubber mat: 7.3 h, 12-mm rubber mat: 6.0 h and concrete: 2.8 h/18 h. Further, Haley *et al.* (2000) revealed higher lying time in cows kept in individual pen having rubber mat flooring. Overall rumination time (minutes) was significantly ( $p < 0.01$ ) higher in cows kept on rubber mat flooring (522.10±4.45) as compare to concrete flooring (435.30±3.21). It might be attributed to feeling of comfort in crossbred cows lied on rubber mat. However, Bhamare (2017) found that there was no significant effect of types of flooring on mean rumination time in indigenous Gir cows.

The overall standing, lying and rumination time (minutes) in cows kept on RM group is presented in Table 2. It showed that when choice of flooring material provided to cows overall standing and sitting time on rubber mat was significantly increased as compared to CON indicating that cows preferred cushioned surface and which lead in increased rumination time.

**Table 2:** Lying and rumination behaviors (minutes) in crossbred cows housed on rubber mat flooring when given free choice of surface

Behaviours	RM	CON	t value	p value
	Mean ± S.E.	Mean ± S.E.		
Standing	196.48±4.61	150.05±5.75	6.305	0
Sitting	431.76±4.96	150.14±5.45	38.232	0
Rumination	306.46±4.15	215.63±1.89	19.905	0

Fregonesi *et al.* (2004) found that when animals had access to the rubber flooring in front of the feed bunk, they spent more ( $P < 0.01$ ) time standing in that location and standing elsewhere in the pen compared with when they were in pens with only concrete flooring. Cows had 4 hour longer sitting time on rubber mat than concrete indicating that cows preferred to lie down on RM. Similarly, Haley *et al.* (2000) reported 4.2

hours longer lie down time in cows housed on mattress than cows housed on a concrete floor. Telezhenko *et al.* (2007) found that significantly higher proportion of cows stood on the side with the soft and extra soft rubber mats (65.1±2.7 and 69.3±2.6%) respectively, compared with the solid concrete (50.9±3.9%) in the study of dairy cow preferences for soft or hard flooring when standing or walking.

Table 3 revealed that cows preferred to stand on rubber mat (73.04%) than concrete floor (26.96%). But 64.52% cows preferred to sit on rubber mat and 35.48% cows preferred to sit on concrete floor when give free choice to cows. When free choice given to cows for standing or sitting 65% of cows prefer to stand or sit on rubber mat, while only 39% cow prefer to stand or sit on concrete floor (Palmer and Wagner, 2003). Elmore *et al.*, 2015 also find similar results inn steers preferring rubber mat over slatted concrete. The overall percentage of slipping was lower (31.74) in cow kept on rubber mat flooring than concrete flooring (74.60) as RM provided better friction on surface to avoid slipperiness. Jain *et al.* (2013) also found that similar results when cows kept on rubber mat compare to concrete floor.

**Table 3:** Effect flooring on standing and sitting preference (%) of crossbred cows housed on the rubber mat flooring

Floor	Standing %	Sitting %	Slipping %
RM	73.04	64.52	31.74
CON	26.96	35.48	74.6

The effects of rubber mat flooring on milk production and milk quality is presented in Table 4. The average milk yield (litre/day) was 8.31±1.00 in cows of RM and it was 8.51±0.76 in cows of CON, however, it was statistically non-significant.

**Table 4:** Effect of rubber mat flooring on average milk yield (l/day) and somatic cell count in crossbred cows

Behaviours	RM	CON	t value	p value
	Mean±S.E.	Mean±S.E.		
Average daily milk yield (l/d)	8.31±1.00	8.51±0.76	-0.154	0.88
Somatic cell count (Cells/ml)	165454.38±4743.17	190201.83±6224.63	-3.162	0.006

It might be due to the short duration of experiment as most of the short duration studies suggested that there was no effect of rubber mat flooring on milk production performance (Kremer *et al.*, 2007; Norberg, 2012 and Eicher *et al.*, 2013). Ruud *et al.* (2010) found that multilayer mats (15.04 kg/day) and mattresses (14.84 kg/day) were associated with greater milk yield compared with concrete (14.17 kg/day) and rubber mat (14.48 kg/day) which showed the effect of softness of flooring in milk yield. On other hand, Bengtsson *et al.* (2009) and Kara *et al.* (2015) found that when cows kept on rubber mats there was significant increase in milk production. Mean somatic cell counts (cells/ml) was 165454.38±4743.17 and 190201.83±6224.63 in RM and CON flooring, respectively. Significantly ( $p < 0.01$ ) lower SSC in RM indicates that rubber mats

might have improved cleanliness of animal and lead to positive effect on udder health and also improved milk quality. The present finding is corroborated with the results of Bengtsson *et al.* (2009).

### Conclusion

The crossbred cows prefers rubber mat for lying, standing and rumination. The problem of slipping incidences in cows housed on concrete floor can largely be solved by using rubber mats. The cows kept on rubber mat flooring produces milk having less somatic cell count.

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