Journal of Animal Research: v.5 n.1, p. 75-79. April. 2015

DOI Number: 10.5958/2277-940X.2015.00012.1

Association of Flooring Materials with Milk Yield and its Composition in Crossbred cows

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Received: 28 January, 2015 **Accepted:** 15 February, 2015

ABSTRACT

Present study was conducted to evaluate the effect of concrete or rubber surface, in combination with open yard with either brick paving or sand bed on milk production and composition in crossbred dairy cows under loose housing system. Total 20 crossbred cows, were assigned to four treatment groups (5 per group) *viz. Control group (T_0):* Concrete floor (in covered feeding area) + Brick paving (in loafing area); *Treatment 1 (T_1):* Concrete floor + Sand bed; *Treatment 2 (T_2):* Rubber mat + Sand bed; *Treatment 3 (T_3):* Rubber mat + Brick paving. Milk yield did not differed significantly (P>0.05) among groups, but it was higher in T_2 followed by T_3, T_0 (control) and T_1. Fat %, SNF % and Total Solids % were almost similar (P > 0.05) in all the groups. Therefore, it can be concluded that provision of rubber mat or sand floor alone does not affect milk production and composition. However, floor combination of rubber mat and sand bed in loose houses showed higher production.

Keywords: Concrete floor, Rubber mat, Sand, Milk, Fat.

India ranks topmost in milk production with a total production of 127.9 MT milk (BAHS 2013). In today's scenario contribution of crossbred cows in India's cow milk production is significantly greater than their share (23%) in total cow population. Further, crossbred cattle population is increasing with rate of 7.58 % per annum. Therefore, in future there will be larger number of high yielding crossbred cattle population in our country. Good management including comfortable housing cannot be ignored while keeping the crossbred cows for milk production. Loose Housing system is most popular in our country, because it is suitable to climate, offers easy group management, preferred for larger group, efficient feeding and cleaning (Nagpal *et al.,* 2005). Flooring of livestock house ultimately decides the walking and lying comfort of the animals (De Belie, 1997; Sonck *et al.,* 1999). However, concrete and brick paved floor which are conventionally being used in feeding and loafing area, have been reported as far away from the ideal walking and standing surface for cows (Phillips and Morris, 2000). Discomfort due to hard flooring surface may affect productivity of animal. In general, milk yield anecdotally is often reported to be improved on softer flooring materials like rubber mat or sand. But little scientific evidence has been published regarding this statement. Calamari *et al.,* (2009) concluded that sand seems to be the best lying surface for dairy cows with better milk yield, milk characteristics and blood metabolites. Few studies reported that rubber flooring did not improved daily average milk yield (Kremer *et al.,* 2007; Pempek and Botheras, 2009), but demonstrated lower somatic cell counts (Kremer *et al.,* 2007). With the increased awareness for animal welfare, provision of elastic or cushioned flooring in animal house is gaining popularity. Under Indian condition available literature on research work exploring effect of the softer flooring is very scanty. Considering aforesaid facts this research

work was carried out to evaluate the effects of concrete or rubber surfaces, in combination with open yard with either brick paving or sand beds on milk production and milk composition of crossbred dairy cows under loose housing system.

Table 1. Effect of different flooring condition on milk yield (Kg, mean±SE) of crossbred cows

Groups (Covered+Loafing area)	Rainy Season (June-August)	Post-Monsoon (September-November)	Overall
Control (T0) (Concrete+Brick paved)	289.60±17.32	294.50±23.73	292.05±14.44[a]
Treatment 1 (T1) (Concrete+Sand bed)	295.43±8.31	280.83±16.62	288.13±9.23[a]
Treatment 2 (T2) (Rubber mat+Sand bed)	314.17±7.17	295.77±8.89	304.97±5.86[a]
Treatment 3 (T3) (Rubber mat+Brick paved)	307.83±11.05	292.87±19.04	300.35±10.90[a]
Overall	301.76±5.81[a]	290.99±8.75[a]	296.37±5.25

means bearing different superscripts differ significantly (P<0.05)

MATERIALS AND METHODS

The present study was conducted in Cattle and Buffalo farm, LPM section, Indian Veterinary Research Institute (I.V.R.I.), Bareilly, Uttar Pradesh. The farm is located at latitude of 28° 22' north and at longitude of 79° 24' east. Cross breed cows (HF/Jersey/BS × Hariana, named as *Vrindavani*) from the herd being maintained at Cattle and Buffalo farm, were used for the experiment.

All the animals were maintained under stall-fed condition in loose housing system. Each covered shed area was attached with open paddock, which allowed the animals to loiter freely. Roof in covered area was made up of Asbestos and was supported by GI pipes. The orientation of long axis of shed was East-West direction. All the experimental cows were milked in the milking parlour, located at the distance of 200 m from experimental shed. Green fodder (maize/berseem/oat) was provided *adlib* to all the animals and dry fodder (wheat straw) was made available at one side of manger all the time. Concentrates feed was provided according to their milk yield twice a day at the time of milking itself. Throughout the study period, the housing (except floor) and feeding for all the animals was kept as identical as possible in the given farm condition.

A total of 24 crossbred cows, from different parities (ranging 1 to 3) and below 45 days in milk were selected initially for experiment and randomly assigned into one of the four treatment groups (6 in each group). Four cows were removed (one from each group), two due to disease (from T_1 &T_3) and two due to very low production during trial (from T_0 & T_2). Therefore, data of only 5 cows from each group was analysed. Groups were statistically identical for parity and body weight. Total four groups were prepared (Figure 1) *viz. Control group (T_0):* Concrete floor (in covered feeding area) + Brick paving (in loafing area); *Treatment 1 (T_1):* Concrete floor (in covered feeding area) + Sand bed (in loafing area); *Treatment 2 (T_2):* Rubber mat (in covered feeding area) + Sand bed (in loafing area) and *Treatment 3 (T_3):* Rubber mat (in covered feeding area) + Brick paving (in loafing area). Therefore, floor in covered feeding area had either concrete floor with grooved surface or with Rubber mat (6×4 feet per sheet, made up of Virgin Rubber), having 20 mm thickness, channels over the surface, over the existing concrete floor. Floor provided in open loafing area was made up either of brick paved floor or Sand bed (avg. 80 mm depth) over the existing brick paved floor.

In sand bedded open area manure and wet spots were removed twice daily. Further, new sand was added as and when required to maintain proper depth. Rubber and concrete floor surface in the covered area were cleaned using forced water after removing solid dung manually. Space for animal in both covered and open area was provided as per BIS norms.

Milk yield of all experimental animals was recorded in the milking parlour twice daily for whole experimental period (June to November). To analyze milk composition (Fat, SNF and Total solids), milk samples were collected every month from all experimental animals during morning and evening.

Statistical analysis

The information collected by data sheet was pooled and analyzed as per standard statistical procedure (Snedecor and Cochran 1994). Repeated measure ANOVA was

Table 2. Effect of different flooring condition on milk composition (mean±SE) of crossbred cows

Groups (Covered+Loafing area)	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Overall
			Milk Fat (%)				
Control (T0) (Concrete+Brick paved)	4.22±0.05	4.01±0.10	4.15±0.04	4.03±0.02	4.12±0.08	4.16±0.10	4.11±0.03[a]
Treatment 1 (T1) (Concrete+Sand bed)	4.14±0.07	4.23±0.06	4.11±0.05	4.16±0.10	4.15±0.08	4.00±0.12	4.14±0.03 [a]
Treatment 2 (T2) (Rubber mat+Sand bed)	4.18±0.08	4.00±0.15	4.15±0.10	4.16±0.05	4.10±0.10	4.05±0.06	4.11±0.04 [a]
Treatment 3 (T3) (Rubber mat+Brick paved)	4.16±0.11	4.07±0.09	4.10±0.05	4.05±0.13	4.17±0.08	4.21±0.07	4.13±0.04 [a]
			SNF (%)				
Control (T0) (Concrete+Brick paved)	8.89±0.05	8.81±0.03	8.83±0.04	8.85±0.06	8.92±0.03	8.99±0.02	8.88±0.02 [a]
Treatment 1 (T1) (Concrete+Sand bed)	8.88±0.04	8.77±0.02	8.87±0.05	8.79±0.05	8.93±0.05	9.01±0.08	8.87±0.02 [a]
Treatment 2 (T2) (Rubber mat+Sand bed)	8.84±0.05	8.77±0.08	8.84±0.03	8.86±0.03	8.90±0.03	8.94±0.04	8.86±0.02 [a]
Treatment 3 (T3) (Rubber mat+Brick paved)	8.78±0.01	8.83±0.02	8.82±0.04	8.76±0.07	8.97±0.05	8.96±0.05	8.85±0.02 [a]
			Total Solids (%)				
Control (T0) (Concrete+Brick paved)	13.11±0.02	12.82±0.08	12.99±0.05	12.88±0.06	13.04±0.06	13.15±0.11	13.00±0.03 [a]
Treatment 1 (T1) (Concrete+Sand bed)	13.02±0.11	13.00±0.07	12.99±0.05	12.95±0.12	13.09±0.07	13.02±0.07	13.01±0.03 [a]
Treatment 2 (T2) (Rubber mat+Sand bed)	13.02±0.11	12.77±0.22	12.99±0.11	13.02±0.05	13.01±0.08	12.99±0.09	12.97±0.05 [a]
Treatment 3 (T3) (Rubber mat+Brick paved)	12.95±0.10	12.90±0.09	12.92±0.08	12.81±0.15	13.14±0.08	13.17±0.09	12.98±0.04 [a]

means bearing different superscripts differ significantly (P<0.05)

applied by using JMP 8.0 software. Tukey test was used for the multiple comparisons.

RESULTS AND DISCUSSION

Average milk yield in different treatment groups has been presented in Table 1. Average milk yield (June to November) in T_0 (control), T_1, T_2 and T_3 group was 292.05 ± 14.44, 288.13 ± 9.23, 304.97 ± 5.86 and 300.35 ± 10.90 Kg, respectively. Although milk yield did not differed significantly ($P > 0.05$) among different groups; but relatively the milk production was higher in T_2 followed by T_3, T_0 (control) and T_1. Season-wise milk yield were higher for rainy season (June-August) compared to post monsoon season (September-November) in T_1, T_2 and T_3 groups. However in T_0 (control) group, lower milk yield

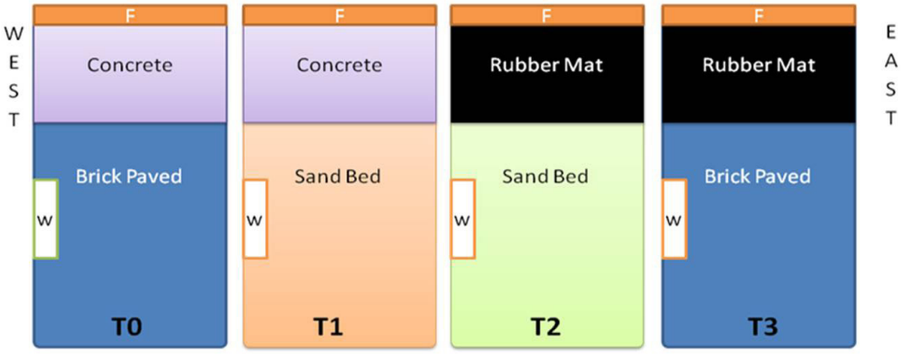

Figure 1. Schematic diagram of experimental shed with different flooring

in rainy season compared to post monsoon season was observed. Milk yield in different seasons among groups did not differed significantly ($P > 0.05$). But relatively the production was higher in T_2 irrespective of seasons.

In support of our findings Kremer *et al.* (2007), Pempek and Botheras (2009) and Eicher *et al.* (2013) also found no difference in mean daily milk yield of cows housed on concrete or rubber floor. Calamari *et al.* (2009) compared four different bedding materials and found sand to be superior to rubber mat and straw for milk production in dairy cows. However, in contrast few studies have shown a positive impact of rubber mat floor on milk yield (Bach *et al.,* 2007; Ruud *et al.,* 2010). Bengtsson *et al.* (2009) revealed that tie stall herds with concrete stalls had lower milk yield than those with rubber mats.

The composition of the milk for different treatment groups has been presented in Table 2. The fat % in T_0 (control), T_1, T_2 and T_3 groups was 4.11 ± 0.03, 4.14 ± 0.03, 4.11 ± 0.04 and 4.13 ± 0.04, % respectively. Fat% was almost similar ($P>0.05$) between groups. The SNF % in T_0 (control), T_1, T_2 and T_3 groups was 8.88 ± 0.02, 8.87 ± 0.02, 8.86 ± 0.02 and 8.85 ± 0.02 %, respectively. SNF % was also followed the same trend and no significant difference ($P > 0.05$) found between groups. The Total solids % in T_0 (control), T_1, T_2 and T_3 groups was 13.00 ± 0.03, 13.01 ± 0.03, 12.97 ± 0.05 and 12.98 ± 0.04 %, respectively. No significant difference ($P > 0.05$) noted between groups for Total solids percent.

In accordance to our results Boyle *et al.* (2005) found no effect on milk composition or on somatic cell counts. Kremer *et al.* (2012) reported that percentage of fat percent showed no difference but protein percent showed a statistically significant between concrete and rubber floor groups. However, Eicher *et al.* (2013) reported that rubber flooring increased milk fat (kg), milk protein (kg) and protein percent during the first lactation.

The non-significant effect of treatment on milk yield or milk composition of cows during study might be due to the fact that the increase in the lying time of treatment groups than control group may not be sufficient to increase the blood flow in the mammary glands. As blood flow to the mammary gland is increased during lying (Metcalf *et al.,* 1992; Rulquin and Caudal, 1992) and when cows are deprived of lying, plasma concentration of growth hormone is reduced which is likely to affect milk production (Munksgard and Lovendahl, 1993). Kremer *et al.* (2012) suggested the fact that cows housed on rubber flooring spend less time lying and more time standing (Fregonesi *et al.,* 2004; Tucker *et al.,* 2006) but still yield the same amount of milk, implies that a lack of lying time could be compensated by a higher feed intake during the time spent at the feed bunk, and therefore, no decrease regarding the milk yield was detected.

CONCLUSION

It can be concluded that effect of floor type on milk production and composition was not evident. None of the floor material investigated was clearly superior to the others in terms of its effect on milk production and composition. However, providing combination of rubber

mat in place of concrete and sand bed instead of brick paving, in loose houses indicated trend toward higher production. Economic feasibility of installing rubber mat and sand bed over existing floor should be considered in respect of production and health benefits over long term.

ACKNOWLEDGEMENTS

Authors are highly thankful to Director, IVRI for providing all the facilities to carry out this research work at Cattle and Buffalo Farm.

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