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Sabin George
Assistant Professor, Department of Livestock Production Management, College of Veterinary and Animal Sciences, Mannuthy, Kerala, India

KS Anil
Professor, Department of Livestock Production Management, College of Veterinary and Animal Sciences, Mannuthy, Kerala, India

VL Gleeja
Assistant Professor and Head, Department of Statistics, College of Veterinary and Animal Sciences, Mannuthy, Kerala, India

ED Benjamin
Assistant Professor, Department of Animal Reproduction, College of Veterinary and Animal Sciences, Mannuthy, Kerala, India

MK Muhammad Aslam
Assistant Professor, Base Farm, Kolahalamedu, Kerala, India

S Pramod
Assistant Professor, Livestock Research Station, Thiruvazhamkunnu, Kerala, India

Corresponding Author
Sabin George
Assistant Professor, Department of Livestock Production Management, College of Veterinary and Animal Sciences, Mannuthy, Kerala, India

Housing and adoption of heat alleviation practices in different types of dairy farms in Kerala

Sabin George, KS Anil, VL Gleeja, ED Benjamin, MK Muhammad Aslam and S Pramod

Abstract
A study was undertaken to study the existing housing practices and adoption level of recommended heat alleviation measures in different types dairy farms in state of Kerala, India. The study concluded that majority of farmers in the state of Kerala provided *pucca* housing system to their dairy animals which was an indication of increased awareness among farmers towards adequate housing management. At the same time the level of adoption of recommended heat alleviation measures were low in all types of farms. Dairy animals are very much susceptible to heat stress and farmers may be encouraged to adopt cost effective adaptation strategies to tide over heat stress.

Keywords: Housing practices, adoption, heat alleviation, dairy farms

1. Introduction
Livestock sector is considered as an integral part of agriculture in India. Agriculture sector in Kerala had witnessed tremendous changes over the past 50 years. Focus shifted away from food crop production to cash crops and subsequently, cropping area of rice declined and that of cash crops like rubber increased (Viswanathan, 2014) [14]. Traditionally, dairying was practised in association with paddy cultivation in the state as a source of additional income. Dairying is evolving as a commercial activity in Kerala with potential to provide full time employment especially to youth. Provision of optimum housing management is essential for the welfare of dairy animals which increases their production and reproduction performance. Optimum housing facilities to dairy animals reduces the energy wastage in maintenance of thermo-neutrality, provides good hygienic condition, reduces incidence of diseases, protects them from predators and provides better working condition to the farmers (Prajapati *et al*., 2015) [10]. The production loss due to direct heat stress in lactating cows necessitates adoption heat alleviation measures in dairy farms. Modification of micro climate becomes essential in changing climate scenario for sustainable productivity of the livestock. However, there was only limited number of studies which focussed on existing housing systems and level of adoption of heat alleviation measures followed by farmers to cope up the tropical humid climate conditions prevailing in the state of Kerala. The present study attempted to fill this gap and study the existing housing practices and adoption level of recommended heat alleviation measures in different type's dairy farms in state of Kerala, India.

2. Materials and Methods
The respondents selected for the present study were dairy farmers, who were members of dairy co-operatives and were enrolled in the Direct Benefit Transfer (DBT) scheme of the Government of Kerala. Since the total population of milk producers who were DBT members was nearly two lakhs, a total sample size of 350 farmers was selected for the study. The farms were categorized into small (1-3 cows), medium (4-10 cows), and large farms (more than 10 cows) (KAU, 2010). Out of the 350 farmers selected for the study, the numbers of small, medium and large farms were fixed as 175, 100, and 75 respectively. A stratified multistage random sampling procedure was used to select the area of study and respondents. In the first stage, the state of Kerala was stratified into five agro-climatic zones (NARP, 1989) [10]. In the second stage, one district from each zone (strata) was randomly selected. In the third stage, from each district two blocks were randomly selected. The sample size for each category of farms in each block was determined in proportion to the number of farmers belonging to each category (probability proportion to size technique).

For this, all the farmers in the selected blocks were enumerated and classified into small, medium, and large farms based on number of cows. The respondents in each group were chosen randomly in each block, proportional to their number in each block. Primary data were collected by means of observation, measurements, in-depth interview, and questionnaires. The details of housing like location, type, floor, roof, etc. were collected by observation and farm area details by actual measurements. Based on this the housing patterns were categorized. Simple tabular analysis with percentage was used to analyse the data regarding housing pattern in different types of farms. The package of practices formulated and recommended to the farmers by the Kerala Agricultural University (KAU, 2010) and review of standard literature formed the basis for selection of recommended heat alleviation practices for the study. The heat alleviation measures selected included housing design, feeding management, provision of automatic drinkers, provision of sprinklers misters, sprinklers or fans, planting shade trees etc. Continued adoption of a practice by a respondent was weighted with a score of one, and non-adoption by a score of zero. Farm's score was calculated by the number of measures adopted by them. Based on this score the farms were classified into three categories as described.

Sl. No.	Category	Score
1	Low	1 or less
2	Medium	2
3	High	3 or more

3. Results and Discussion

The present study revealed that the average area for cattle sheds in small, medium and large farms was 199.07 sq.ft. (0.5 cents), 518.35 sq.ft. (1.3 cents) and 2024.8 sq.ft. (5.06 cents) respectively. Figure 1 showed the details of type of housing followed in different farms. In small farms, 88.0 and 12.0 per cent of houses were permanent and temporary respectively. In medium farms the respective figures were 94.0 and 6.0 per cent. In large farms 100 per cent of cattle sheds were permanent type. These findings were similar to the findings of Rajasekhar *et al.* (2018) and Kochewad *et al.* (2013) [6], who found that majority of farmers provided pucca type of housing to their dairy animals. In contrast to this Sabapara *et al.* (2010) [12], Roy *et al.* (2013), Varaprasad *et al.* (2013) [15] and Patil *et al.* (2015) [9] reported predominance of kutcha type of houses in their study areas. The hot and humid climate and intensive nature of production necessitates permanent housing systems in the state. Well-designed permanent houses provided adequate floor space, lighting and ventilation to the animals as reported by Sreedhar *et al.* (2017) [14]. Janaka (2017) [3] found that proper housing not only protected animals from inclement weather conditions but also helped in maintaining cleanliness and hygiene of the sheds. The results of the present study showed that almost all the farms in large category and majority for farmers in small and medium category had constructed permanent sheds for their animals which is an indication of increased awareness among farmers towards adequate housing management.

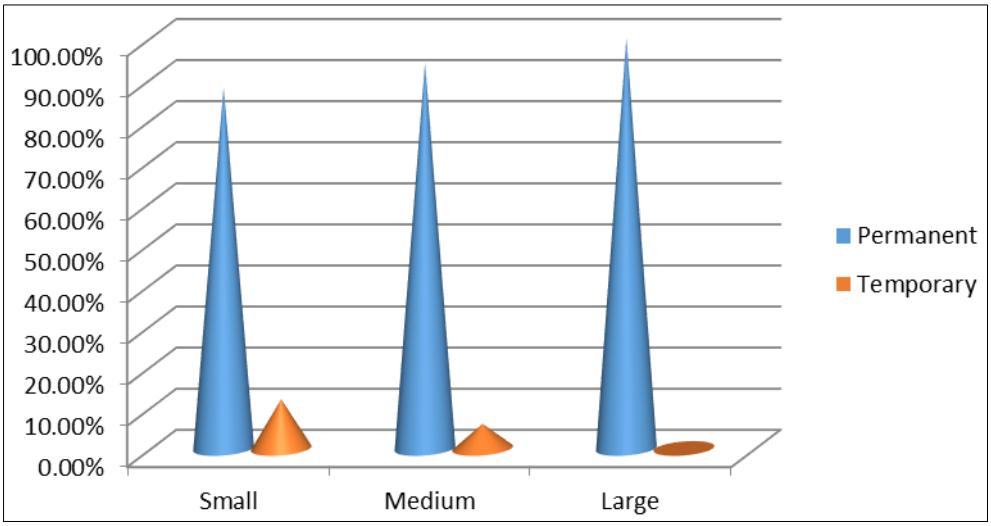

Fig 1: Type of housing in different farms

Classification of cattle houses based on building pattern is presented in Table 1. Eleven types of building pattern were observed, based on the position of cattle shed (related to human house), floor and roof. In small farms, separate house with metal sheet roof and concrete floor was the predominant type of building pattern (37.1 %) followed by separate -tiled – concrete (29.70%) type. The separate- metal sheet –concrete (56%) and separate-tiled- concrete (14%) types were more prevalent in medium farms also. In majority of large farms separate- metal sheet –concrete (86.70%) type of housing followed by separate -thatched – concrete (10.70%) pattern was present. Gupta *et al.* (2009) reported similar results from Rajasthan where majority of farms were having a separate stall within or outside the human dwelling. But these results were disagreement with Sabapara *et al.* (2010) [12] and Kishore *et al.* (2013) [5], Sinha *et al.* (2010) [13] and Hussain *et al.* (2019) [2] who all reported predominance earthen floor houses in their study areas. The separate position of animal houses, use of concrete as flooring and metal sheet as roofing material followed in majority farms irrespective of the herd size might be the more suited housing system for the humid climate of the state.

Table 1: Classification of cattle houses based on building pattern in different farms

Farm type	House Type										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Small	14	52	65	5	6	5	6	12	3	2	5
	8%	29.70%	37.10%	2.90%	3.40%	2.9%.	3.40%	6.90%	1.70%	1.10%	2.90%
Medium	4	14	56	0	14	2	6	2	1	1	0
	4%	14%	56%	0%	14%	2%	6%	2%	1%	1.10%	0%
Large	0	2	65	0	8	0	0	0	0	0	0
	0%	2.70%	86.70%	0%	10.70%	0%	0%	0%	0%	0%	0%

1. Temporary(Floor without concrete, with stone, mud or palm stem floor paneling
2. Separate (position) +Tiled (roof)+Concrete(floor)
3. Separate Metal Sheet (roof)+Concrete(floor)
4. Separate + Concrete + Concrete
5. Separate +Thatched + Concrete
6. Separate +Silpaulin sheet +Concrete
7. Attached+Metal sheet+ concrete
8. Attached +Tiled + Concrete
9. Attached +Concrete+ Concrete
10. Attached+ Thatched +Concrete
11. Attached + Silpaulin+ Concrete

The adoption level of heat stress alleviation measures followed in the farms are presented in the Table 2. In small and medium farms majority of the farmers were at low level of adoption and in large farms majority (64.0 %) were at medium level of adoption heat alleviation methods. In small farms, the proportion with low, medium and high level of adoption of heat alleviation measures was 60.0, 39.4 and 0.6 per cent respectively. In medium farms, 53.0, 38.0 and 9.0 per cent had low, medium and high level of heat stress alleviation measures. In large farms the respective figures were 1.3, 64.0 and 34.7. The findings of low level of adoption of heat alleviation measures in the present study was in agreement with Kalyani *et al.* (2021) [4] who reported that majority of farmers were not taking any measures to protect animals from extreme summer. The low level of adoption of management practices to protect dairy animal from extreme heat might be due to lack of awareness, scarcity of resources or labour shortage. The importance of heat stress alleviation measures to be followed for crossbred animals in the climate change scenario was highlighted by many authors like Kochewad *et al.* (2013) [6], Maiti *et al.* (2014) [7] and Das and Singh (2014) [1]. Maiti *et al.* (2014) [7] reported the case of livestock rearers of coastal Odisha and West Bengal who perceived changing climatic scenario and followed several coping mechanisms to cope up with negative impact of climate change. They also emphasised that farmers should be encouraged to follow cost effective adaptation strategies. Das and Singh (2014) [1] reported that modification in housing and arrangement of cooling in cattle shed had reduced the heat stress and thereby decreased the milk drop due to change of microenvironment.

Table 3: Level of adoption of heat stress alleviation measures in different farms

Farm Type	Number/Per cent	Heat alleviating measures		
		Low	**Medium**	**High**
Small	Number	105	69	1
	Per cent	60.0%	39.4%	.6%
Medium	Number	53	38	9
	Per cent	53.0%	38.0%	9.0%
Large	Number	1	48	26
	Per cent	1.3%	64.0%	34.7%
Overall	Number	159	155	36
	Per cent	45.4%	44.3%	10.3%

4. Conclusion

The study concluded that majority of farmers in the state of Kerala provided pucca housing system to their dairy animals which was an indication of increased awareness among farmers towards adequate housing management. At the same time the level of adoption of recommended heat alleviation measures were low in all types of farms. Dairy animals are very much susceptible to heat stress and farmers may be encouraged to adopt cost effective adaptation strategies to tide over heat stress.

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