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Housing Patterns for Dairy Cattle in Nilgiri District of Tamil Nadu, India

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Abstract

A field work was conducted to assess the effect of climatic variables on dairy cattle under different housing patterns in Nilgiri, the Hilly zone of Tamil Nadu, India. Initially a survey was conducted in this agroclimatic zone of Tamil Nadu with a prestructured interview schedule for identifying the present dairy cattle housing patterns, production and management measures. The annual compounded growth rates of T. maximum, T. minimum and temperature humidity index (THI) were worked out on the basis of the representative areas selected for the study. The result showed that the highest values for T. Max (Mean±SD) were recorded in metal sheet roofed shelter (22.13±1.66 ºC); whereas T. Min was reported in open housing (11.94±1.09 ºC). However, during cold season there was no significant difference ($p<0.05$) between the housing systems in temperature and THI at 8:00 am. The overall result of analysis of housing pattern in hilly zone indicated that the prevailing environmental condition in hilly zone is conducive for commercial dairy farming in all seasons.

Keywords: *Dairy housing, hilly areas, temperature, THI, season*

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INTRODUCTION

Milk production and health of dairy animals depend mostly on environment in which they live. A satisfactory environment for any farm animal is the one that ensures not only increase in productivity but also meets the health and behavioral needs of the animals. The thermal environment has a strong influence on dairy animals with air temperature and relative humidity having the primary effect, but modified by wind, precipitation, humidity and radiation. Ideally, the effect of thermal environment can be described in terms of effective ambient temperature which combines the various climatic events.

In India, the upper temperature limit of comfort zone for maximum milk production is 27°C, about two degrees higher than the same reported in temperate countries [1]. This is perhaps, because the crosses of exotic breed with native Indian breeds have to some extent, adapted to climatic conditions in the country. However, the average annual temperature is higher than this upper critical limit also in several parts of the country, particularly southeastern region comprising of state of Andhra Pradesh and Tamil Nadu, India. Even though daily maximum temperatures exceeds 40°C for a few hours each day, cool nights that help stored heat to be radiated to the surroundings allows dairy cattle to produce at near optimal levels. Classical work [2] reported that milk yield and dry matter intake exhibited significant declines when maximum temperature humidity index (THI) reached 77.

Animal productivity and efficiency are significantly influenced by environmental factors. Ambient temperatures above the thermal neutral zone are detrimental to lactation, growth, and reproduction in all agriculturally important species, but the effects on the dairy industry are the most economically severe [3]. Studies conducted in New Zealand have demonstrated that the body temperature of dairy cows is related to air temperature and solar radiation [4].

Hence this study was conducted to compare the different housing pattern used for dairy cattle to find out the suitable one based on the climatic variables to hilly zone of Tamil Nadu, India.

MATERIALS AND METHODS

The study was conducted in Nilgiri district, the hilly zone of Tamil Nadu, India having the highest cattle population and total milk production comprised the study locality. Moreover, no other study of similar nature had been reported from these areas. Initially survey was conducted and based on the survey; the major housing systems existing in the region were identified and categorized for further detailed investigation. Farmers with at least five cows were selected with the major types of housing pattern identified for conducting the field investigation. A total of thirty farmers/farms (five housing types with six replicates) were selected from this agroclimatic zone. The maximum–minimum thermometer and digital thermohygrometers were installed in the dairy cattle house of various shelter types for measurement of the climatic variables and data were recorded. The study was conducted throughout the year with the duration of one year and the period was divided into four seasons as per Ref. [5] as South West monsoon (June–August), North East monsoon (September–November), Cold season (December–February) and Summer season (April–May). The collected data were statistically analyzed by one way analysis of variances (ANOVA) for finding the difference between the groups by using statistical package SPSS 17. The significance was tested using Duncan's multiple range test [6].

RESULTS AND DISCUSSION

There was highly significant difference in the season-wise climatic variables in various housing types in hilly zone and the details are presented in Table 1.

Table 1: *Mean ± SD of Season-Wise Climatic Variables in Various Housing Types in Nilgiri.*

Season	Climatic variables	House type					Over all	F value	P value
		Thatch (n=15)	Tile (n=15)	Metal (n=15)	CC (n=15)	Open (n=15)			
South-West Monsoon	T. Max (ºC)	20.24 ±1.86^{ab}	21.64 ±1.86^{c}	22.13 ±1.66^{c}	21.44 ±1.86^{bc}	19.34 ±1.86^{a}	20.96 ±2.05	5.870	0.000
	T. Min (ºC)	13.25 ±1.23^{a}	15.29 ±1.17^{b}	15.40 ±1.19^{b}	14.80 ±1.19^{b}	11.94 ±1.09^{c}	14.14 ±1.77	24.422	0.000
	T. at 8:00 am (ºC)	14.90 ±1.19^{ab}	15.86 ±1.19^{c}	15.55 ±1.19^{bc}	16.27 ±1.17^{c}	14.30 ±1.19^{a}	15.38 ±1.35	6.565	0.000
	THI at 8:00 am	58.74 ±2.10^{ab}	60.43 ±2.11^{c}	59.95 ±2.07^{bc}	61.27 ±2.05^{c}	57.79 ±2.10^{a}	59.63 ±2.38	6.543	0.000
	T at 2:00 pm (ºC)	19.34 ±1.86^{a}	20.24 ±1.86^{ab}	21.84 ±1.86^{c}	21.44 ±1.86^{bc}	18.94 ±1.86^{a}	20.36 ±2.14	6.959	0.000
	THI at 2:00 pm	66.32 ±3.08^{ab}	67.88 ±3.06^{bc}	70.57 ±3.02^{d}	69.82 ±3.01^{cd}	65.47 ±3.05^{a}	68.01 ±3.56	7.766	0.000
North-East Monsoon	T. Max (ºC)	20.51 1.15^{a}	21.91 ±1.15^{b}	22.35 ±1.16^{b}	21.71 ±1.15^{b}	19.61 ±1.15^{c}	21.22 ±1.51	14.471	0.000
	T. Min (ºC)	13.03 ±.69^{a}	14.95 ±0.70^{bc}	15.13 ±0.69^{c}	14.53 ±0.69^{b}	11.73 ±0.69^{d}	13.88 ±1.47	66.904	0.000
	T. at 8:00 am (ºC)	14.63 ±.69^{a}	15.47 ±0.71^{b}	15.24 ±0.67^{b}	16.03 ±0.69^{c}	14.03 ±0.69^{d}	15.08 ±0.97	18.802	0.000
	THI at 8:00 am	58.28 ±1.23^{a}	59.76 ±1.28^{b}	59.44 ±1.19^{b}	60.88 ±1.22^{c}	57.33 ±1.23^{d}	59.14 ±1.72	18.625	0.000
	T at 2:00 pm (ºC)	19.61 ±1.15^{a}	20.51 ±1.15^{b}	22.11 ±1.15^{c}	21.71 ±1.15^{c}	19.21 ±1.15^{a}	20.63 ±1.60	18.331	0.000
	THI at 2:00 pm	66.64 ±1.86^{a}	68.13 ±1.86^{b}	70.76 ±1.84^{c}	70.03 ±1.84^{c}	65.77 ±1.85^{a}	68.27 ±2.63	19.964	0.000

Cold	T. Max (ºC)	21.76 ±1.16^{a}	23.16 ±1.16^{b}	23.41 ±1.16^{b}	22.96 ±1.16^{b}	20.86 ±1.16^{c}	22.43 ±1.49	13.063	0.000
	T. Min (ºC)	10.49 ±2.22^{c}	12.40 ±2.09^{b}	12.60 ±2.09^{b}	12.00 ±2.09^{b}	9.20 ±2.09^{a}	11.34 ±2.44	7.059	0.000
	T. at 8:00 am (ºC)	12.10 ±2.09	12.95 ±1.99	12.89 ±1.97	13.52 ±1.98	11.50 ±2.09	12.59 ±2.10	2.298	0.067
	THI at 8:00 am	53.82 ±3.73	55.26 ±3.53	55.29 ±3.46	56.38 ±3.49	52.93 ±3.73	54.73 ±3.70	2.151	0.084
	T at 2:00 pm (ºC)	20.86 ±1.16^{a}	21.76 ±1.16^{b}	23.36 ±1.16^{c}	22.96 ±1.16^{c}	20.46 ±1.16^{a}	21.88 ±1.60	17.954	0.000
	THI at 2:00 pm	67.65 ±1.58^{a}	69.05 ±1.63^{b}	71.60 ±1.51^{c}	70.74 ±1.62^{c}	66.87 ±1.60^{a}	69.18 ±2.37	23.793	0.000
Summer	T. Max (ºC)	22.67 ±1.29^{a}	24.07 ±1.29^{b}	24.61 ±1.20^{b}	23.87 ±1.29^{b}	21.77 ±1.29^{a}	23.40 ±1.62	12.259	0.000
	T. Min (ºC)	13.29 ±1.83^{a}	15.35 ±1.83^{b}	15.36 ±1.81^{b}	14.76 ±1.81^{b}	11.96 ±1.81^{c}	14.15 ±2.21	10.026	0.000
	T. at 8:00 am (ºC)	14.86 ±1.81^{ab}	15.84 ±1.82^{b}	15.68 ±1.71^{b}	16.08 ±1.68^{b}	14.26 ±1.81^{a}	15.34 ±1.85	2.780	0.033
	THI at 8:00 am	58.67 ±2.97^{ab}	60.23 ±3.05^{b}	60.04 ±2.83^{ab}	60.69 ±2.84^{b}	57.83 ±2.91^{a}	59.49 ±3.04	2.512	0.049
	T at 2:00 pm (ºC)	21.77 ±1.29^{ab}	22.67 ±1.29^{b}	24.27 ±1.29^{c}	23.87 ±1.29^{c}	21.37 ±1.29^{a}	22.79 ±1.70	14.416	0.000
	THI at 2:00 pm	68.69 ±2.22^{ab}	70.01 ±2.29^{bc}	72.39 ±2.38^{d}	71.62 ±2.37^{cd}	67.88 ±2.17^{a}	70.12 ±2.81	10.358	0.000

(p<0.01) indicates significant at 1 per cent level.
(p<0.05) indicates significant at 5 per cent level.

There were significant differences (p<0.01) in the T. max, T. min, temperature at 8:00 am, THI at 8:00 am, temperature at 2:00 pm and THI at 2:00 pm in all the housing types during South West monsoon season. Highest values for T. max (Mean ± SD) was recorded in metal sheet roofed shelter (22.13±1.66 ºC), whereas T. min was reported in improper housing (11.94±1.09 ºC) selected on par with open housing system. Temperature and THI at 8:00 am were found to show significant difference (p<0.01) between the housing systems and the highest values of 16.27±1.17 ºC and 61.27±2.05 were observed in cement sheet roofed shelters.

During North East monsoon, Cold and Summer seasons, the T. max, T. min, temperature at 8:00 am, THI at 8:00 am, temperature at 2:00 pm and THI at 2:00 pm showed the same trend with respect to the housing systems. However, during Cold season there was no significant difference (p<0.05) between the housing systems in temperature and THI at 8:00 am. There was a highly significant difference in the season-wise climatic variables in various housing types in hilly zone and it is evident from Table 1. The plastic sheet wrapped housing system recorded the lowest values for all the climatic parameters under the study.

Temperature and THI at 2:00 pm were found to be highest under metal sheet roofed housing during all the seasons in the zone. The use of old tar barrel and poor ventilation in these shelters might have contributed much to these higher values.

The THI was found to be below the critical mean of 72 [7] during all the periods under all housing systems except in metal sheet roofed shelters during Summer season.

The maximum and minimum temperature recorded during all the four seasons in all housing systems were within the comfort zone for maximum milk production recommended by Fuquay [8] and Dutt *et al.* [1].

CONCLUSION

The seasonal effect of climatic variables in hilly zones denoted that the environmental condition in hilly zone is conductive to commercial dairy farming in all the seasons.

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