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# Effect of Water Sprinkling Over Shed-net Covered Cattle Shed on Shed Environment and Milk Yield of Cows During Summer Season

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## ABSTRACT

The experiment was conducted in the cattle shed of OUAT livestock farm. The shed was partitioned into two equal rooms by a brick wall each having the dimension of 25 x 30 ft size. In one part, 90% grade green shed-net was covered over the asbestos roof and five micro water sprinklers were fitted over the long axis of roof. The normal asbestos roof of other part of the shed was left as such. In animal housing the roof plays a primary role in the determination of thermal exchanges of heat in animals. The experiment was conducted for one week in hot summer during second week of May. Water was sprinkled over the shed-net covered asbestos roof for 10 minutes by help of a 0.5 hp electric motor pump at hourly intervals from 11AM to 3 PM during hot period of the day when outside ambient temperature raised above 36°C. The THI of the shed-net covered shed with water sprinkling was found to be within mild heat stress range (72-79) during the whole day with only 0.2 L mean decrease in average milk yield per cow over one week indicating a better microenvironment for cows in hot summer. But in case of the cows kept under normal asbestos shed there was a decrease of 0.43 L in average milk yield per cow over the same period indicating that moderate heat stress during noon period affected the productivity of cows to some extent.

*Key words:* Milk yield, Shed net, THI, Water sprinkling.

## Introduction

All animals have an ambient environmental temperature & humidity range termed as thermo neutral zone. This is the range of temperatures that are conducive for health and performance. Dairy cows begin to show mild heat stress when the temperature humidity index (THI) goes above 72, Habeeb *et al.* (2018), Gaughan *et al.* (2008). In case of dairy animals it is one of the leading causes of affecting milk production during summer months in India, Bohmanova *et al.* (2007), Das *et al.* (2016), Pragna *et al.* (2017). Corrugated aluminum/GI sheet, asbestos

are still widely used as shed roof material for organized and semi organized cattle farms all over the world, Samer (2010); Narwaria *et al.* (2017). But these roofs being good heat conductor contribute to heat stress in animals during hot summer. In animal housing the roof plays a primary role in the determination of thermal exchanges of heat in animals, Liberati (2008). Shade cloth roofing and agro-net shading roof offered a more efficient way to minimize heat stress than that of normal roof, Khongdee *et al.* (2010); Kamal *et al.* (2013). Therefore a study on effect of shed net covering with water sprinkling over asbestos roof during hot summer on micro-en-

vironment of shed and milk yield of cows was conducted for heat stress management.

## Materials and Methods

The experiment was conducted in the cattle shed of OUAT livestock farm having asbestos roof, brick wall, concrete floor and other recommended specifications like floor space, air space, ventilation etc. The shed was partitioned into two equal rooms by a brick wall each having the dimension of 25 x 30 ft size. In one part, 90 % grade green shed-net was covered over the asbestos roof and five micro water sprinklers were fitted over the long axis of roof. The other part of the shed was left as such with normal asbestos roof. The experiment was conducted for one week in hot summer during second week of May. The sprinklers were run by a 0.5 hp electric motor pump. Water was sprinkled over the shed-net covered asbestos roof for 10 minutes till it become completely wet at hourly intervals from 11AM to 3 PM during hot period of the day when outside ambient temperature raised above 36 °C. The ambient temperature and relative humidity of both the sheds and outside the shed were recorded on hourly basis from 8.00 AM to 5.00 PM by help of digital thermometer and hygrometers and the temperature humidity index (THI) was calculated out as per Habeeb *et al.* (2018). Armstrong (1994) considered THI <72 as a thermal comfort zone (assuming the THI does not drop below the thermo-neutral conditions of dairy cows, which induces cold stress), 72 to 79 as mild heat stress, 80 to 90 as moderate heat stress, and >90 as severe heat stress. Eight nos. of

medium yielding milking cross bred cows were randomly divided in to two groups and kept in two parts of the shed, maintained with recommended feeding and management practices. The milk yields of individual cows were recorded on daily basis during the experiment.

## Results and Discussion

During the experimental period the outside ambient temperature ranged from 31.5 to 40.1 °C during 8.00 AM to 5.00 PM while, the inside temperature of the shed-net covered shed with water sprinkling at hourly intervals from 11.00 AM to 3.00 PM during same period ranged from 30 - 36.2 °C with THI varying from 72 – 79. The inside ambient temperature of the normal asbestos shed during the same period ranged from 30.5 – 38.4 °C with THI varying from 72



**Fig. 1.** Outside view of the normal asbestos shed and shed-net covered shed

**Table 1.** Mean ambient conditions of asbestos roof shed and shed-net covered shed with water sprinkling during summer season

Time	Asbestos roof shed			Shed net covered shed with water sprinkling			Out side	
	Amb. Temp (°C)	RH (%)	THI	Amb. Temp (°C)	RH (%)	THI	Amb. Temp (°C)	RH (%)
	8.00 AM	30.5	85	72	30	85	72	31.5
9.00 AM	32	78	74	31	80	73	32.5	62
10.00 AM	33	74	76	32	75	74	34	55
11.00 AM	34.5	66	78	33.5	72	76	36	53
12.00 PM	36	60	80	34.5	70	77	37.5	54
1.00 PM	37.5	52	82	35.2	66	78	39	56
2.00 PM	38.4	46	83	36.2	65	79	40.1	46
3.00 PM	37.2	50	82	35	62	78	38	48
4.00 PM	35	60	79	33	68	76	35.5	56
5.00 PM	32.5	72	75	30	76	72	32	60

– 83. Similar finding of higher temperature rage in asbestos roof shed was reported by Vanitha *et al.* (2009). It was observed that the inside ambient temperature of the shed net covered shed with water sprinkling was 4 °C less than the outside temperature during noon in hot summer. The relative humidity of air inside the shed-net covered shed with water sprinkling varied from 85 - 62 % as compared to the value of 85 -50 and 75 - 46 % in normal asbestos shed and outside shed, respectively. The THI of the shed net covered shed with water sprinkling was found to be within mild heat stress range (72-79) during the whole day indicating comparatively a better environment for cows in hot summer. But in normal asbestos shed, moderate heat stress was prevailed during noon from 12.00 PM to 3.00 PM along with mild heat stress at other hours of the day resulting in a more stress full environment for cows.

The daily milk yield of cows at the starting of the experiment kept under shed-net covered shed with water sprinkling varied from 4.6 – 6.8 L. Over one week of observation during hot summer the average

daily milk yield was decreased by 0.2 L, when the average max. inside temperature was 36.2 °C with only mild heat stress prevailing throughout the day, which did not affect the productivity of cows much. Per unit increase in THI beyond 72, 0.2 kg reduction in milk yield was reported in high yielding dairy cows, West (2003). Similarly, the daily milk yield of cows at the starting of the experiment kept under normal asbestos shed varied from 4.5 – 6.4 L. Over one week of observation during the same period the average daily milk yield was decreased by 0.43 L, when the average max. inside temperature was 38.4 °C with moderate heat stress prevailing from 12.00 noon to 3.00 PM which affected the productivity of cows to some extent. Macro and micro environment of the shed has a lot of effect on physiological stress or comfort of the animals, Roy and Chatterjee (2010). Highly significant ( $P < 0.01$ ) decrease of daily milk yield as well as fat and protein content induced by heat stress conditions were observed by Gantner *et al.* (2011). It was observed that the decrease in daily milk yield of the cows kept under shed-net covered



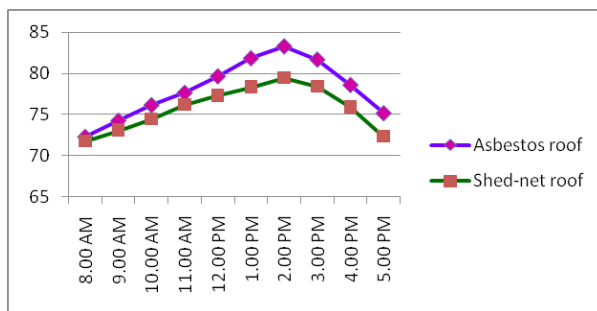
Fig. 2. Inside view of the normal asbestos shed and shed-net covered shed

**Table 2.** Daily max.outside and inside temp. and milk yield of the cows maintained under shed net covered shed with water sprinkling in summer season.

Ambient condition								
	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Avg.
Max. Day Temp(°C)	40.1	40.2	40.2	40.4	40.2	40	39.9	40.1
Max. Inside temp. (°C)	36.2	36.3	36.2	36.3	36.3	36.2	36.2	36.2
Milk yield, L								
	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Final Decrease
Cow-1	6.5	6.4	6.4	6.3	6.3	6.3	6.3	0.2
Cow-2	5.2	5.1	5.0	5.0	5.0	5.0	5.0	0.2
Cow-3	6.8	6.6	6.6	6.6	6.5	6.5	6.5	0.3
Cow-4	4.6	4.6	4.5	4.5	4.5	4.5	4.5	0.1
Avg.	0.20							

**Table 3.** Daily max.outside and inside temp. andmilk yield of the cows maintained under normal asbestos shed in summer season.

Ambient condition								
	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Avg.
Max. Day Temp (°C)	40.1	40.2	40.2	40.4	40.2	40	39.9	40.1
Max. Inside temp. (°C)	38.4	38.5	38.4	38.5	38.5	38.4	38.4	38.4
Milk yield, L								
	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Final Decrease
Cow-1	6.4	6.3	6.3	6.2	6.1	6.1	6.0	0.4
Cow-2	4.8	4.6	4.5	4.5	4.5	4.4	4.3	0.5
Cow-3	5.0	4.8	4.8	4.7	4.6	4.6	4.5	0.5
Cow-4	4.5	4.5	4.4	4.4	4.3	4.3	4.2	0.3
<b>Avg.</b>	<b>0.43</b>							

**Fig. 3.** Mean hourly THI of normal asbestos shed and shed-net covered shed with water sprinkling in summer season

shed with water sprinkling there was less than 50% of the corresponding value of the cows kept under normal asbestos shed indicating a better microenvironment for cows inside the shed-net covered shed with water sprinkling during hot summer.

## Conclusion

The THI of the shed net covered shed with water sprinkling was found to be within mild heat stress range (72-79) during the whole day with only 0.2 L decrease in average daily milk yield over one week of observation indicating a better microenvironment for cows in hot summer. But there was a decrease of 0.43 L in average milk yield over the same period in case of the cows kept under normal asbestos shed indicating that moderate heat stress during noon period affected the productivity of cows.

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**Conflict of interest:** There is no conflict of interest between the authors.

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