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Economics of Using Mist and Fan System During Summer and in-house Shelter During Winter for Alleviating Environmental Stress in Dairy Animals

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I

INTRODUCTION

The zones of thermal comfort are primarily dependent on the species, physiological status of animals, relative humidity, velocity of air and degree of solar radiation (Hafez, 1969; McDowell, 1972). When the ambient temperatures venture outside the thermoneutral zone, the dairyman can incur huge losses due to adverse effect on animal's productivity. At high temperature, heat stress management systems that include water shower/mister, sprinklers and fans are used to improve milk production and reproductive efficiency (Thatcher *et al*., 1974; Huang *et al*., 1986; Igono *et al*., 1987; Aii *et al*., 1988, Chauhan, 2004; Anjali and Singh, 2005, 2006). In the case of buffaloes, the traditional system of wallowing is practised in villages. Provision of mister and fan effectively sustain milk production by maintaining feed intake, but it should be cost effective so that medium and progressive farmers can make effective use of it. Therefore, the present study was conducted to evaluate the economics of using mist and fan system/wallowing during hot dry and hot humid seasons and of close housing during winter.

II

DATA AND RESEARCH METHODOLOGY

The study was conducted on 12 each of lactating healthy Karan Fries (Holstein x Tharparker) cows and 12 Murrah buffaloes in early lactation of the average 75.5±6.11 and 78.4±8.05 days in cows and buffaloes, respectively. While dividing the animals in two groups, age, parity, stage of lactation and milk yield were taken into consideration.

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Mist and Fan System

Mist particles are sprayed onto the cow's body to wet the hair. A fan is used to evaporate the moisture, as a way of cooling the cows (Figure 1).

Management of Cows During Hot-Dry and Hot-Humid Season

All the cows were kept under loose housing system with brick floor and shaded manger. The cows were provided *ad lib* green maize (*Zea mays*) fodder and water. The quantity of fodder consumed by buffaloes of both the groups was measured at weekly intervals. The concentrate mixture was offered at milking @ 1.00 kg ration/2.5 kg milk produced. The cows were machine-milked during morning (6.00 A.M.), noon (12.00 P.M.) and evening (7.00 P.M.) and milk yield of individual cow was recorded at each milking. The animals were divided into two groups of six each. Group I cows were kept without mist (control) while group II cows were kept under mist and fan from 11.00 A.M. to 4.00 P.M. daily.

Management of Cows During Winter Season

Group I cows (n=6) were kept under loose housing system (control group) as per management practices followed in the Institute's herd. The cows of group II (n=6) were managed separately in pucca houses (experimental group) with cement flooring. The floor of the house was covered with paddy straw. The cows of both the groups were provided *ad lib* green berseem (*Trifolium alexandrium*). The cows were machine-milked during morning (6.00 A.M.), noon (12.00 P.M.) and evening (7.00 P.M.) and the milk yield of individual cow was recorded at each milking.

Management of Buffaloes During Hot-Dry and Hot-Humid Season

All the experimental buffaloes (n=6) were kept under loose housing system and were provided *ad lib* green maize fodder and water. The concentrate ration was offered at the time of milking based on milk production (i.e., 1.5 kg ration/2.5kg milk produced). Group I buffaloes were kept under showers (control) from 11.00 A.M. to 4.00 P.M. while group II buffaloes were allowed to wallow in a water pond (experimental). The buffaloes were hand milked by the expert milkers and milk yield of individual buffalo was recorded.

Management of Buffaloes During Winter

Group I buffaloes were kept under loose housing system (control group) as per management practices followed in the Institute's herd. The buffaloes of group II were managed separately in pucca houses (experimental group) with cement flooring. The

floor of the house was covered with paddy straw. The buffaloes of both the groups were provided *ad lib* green berseem (*Trifolium alexandrium*) while concentrate ration was offered as per the management practices mentioned earlier. The buffaloes were hand milked by the expert milker and milk yield of individual buffalo was recorded.

III

RESULTS AND DISCUSSION

Considering the market cost of various inputs at the time of experiment, economics of using mist and fan system was calculated. The following variables were considered for calculation.

1. Cost of infrastructure required for mist.
2. Cost of feed offered to the animal.
3. Cost of electricity and water charges.
4. Cost of treatment of animals of both groups during different seasons.
5. Cost of additional milk produced by experimental animals in different experiments and seasons.
6. Cost of maintenance of infrastructure for experimental group, i.e., mist and fan system.
7. Cost of labour for bedding/removal of bedding during winter.

The cost of following variables was taken as constant and not included as the input cost. It was similar for both the groups.

1. Number of labour and labour charges for fodder distribution, cleaning and milking operations
2. Cost of loose housing establishment

COST OF ESTABLISHMENT OF INFRASTRUCTURE FOR SIX ANIMALS
(MIST AND FAN/SHOWER SYSTEM)

Name of item (1)	Units/No. (2)	Cost (Rs.) (3)
1. GI Pipe	20 ft.	320.00
2. Mist fogger/shower	3	195.00
3. GI Tee	3	45.00
4. Socket	2	18.00
5. GI elbow	2	24.00
6. GI union (1/2”)	1	35.00
7. Gate valve (1/2”)	1	125.00
8. Pump (0.25 hp)	1	2000.00
9. Fan (48”)	2	1800.00
10. Miscellaneous		100.00
	Total	4662.00

IV

INPUT AND OUTPUT COST FOR EXPERIMENTAL GROUP

The design for mist and fan system used in the study is shown in Figure 1. The input and output costs calculated for cows and buffaloes for "30 days" duration in three seasons, viz., hot-dry, hot-humid and winter seasons.

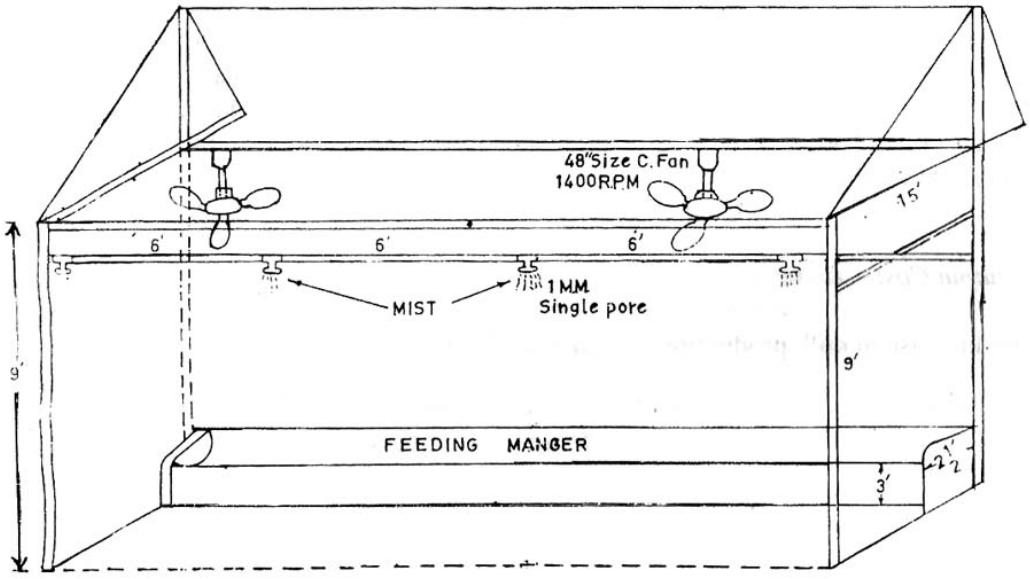

Figure 1. Design for Mist and Fan system

Cows (Hot-Dry Season)

Input Cost

(i) Electricity consumption by fan Rs. 4/day x 30 days = Rs. 120.00
(ii) Extra fodder consumed @ 4.83 kg/day/animal x 6 animals
= 28.98 kg/day
Cost of 28.98 kg fodder = Rs. 7.5/day x 30 days = Rs. 225.00
(iii) Water from mist Rs. 4/day x 30 days = Rs. 120.00
Total = Rs. 465.00

Output Cost

(i) Increase in milk production @ 2.12 kg/day/animal x 6 animals
= 12.72 kg milk/day
12.72 kg x Rs. 10 (Cost of milk/kg) = Rs. 127.20 x 30 days =Rs. 3816.00
Net profit = Rs. 3816.00 – Rs. 465.00 = Rs. 3351.00

Cows (Hot-Humid Season)

Input Cost

(i) Electricity consumption by fan Rs. 4/day x 30 days = Rs. 120.00
(ii) Extra fodder consumed @ 3.98 kg/day/animal x 6 animals
= 23.88 kg/day
Cost of 23.88 kg fodder = Rs. 6.0/day x 30 days = Rs. 180.00
(iii) Water from mist Rs. 4/day x 30 days = Rs. 120.00
Total = Rs. 420.00

Output Cost

(i) Increase in milk production @ 0.83 kg/day/animal x 6 animals
= 4.98 kg milk/day
4.98 kg x Rs. 10 (Cost of milk/kg) = Rs. 49.80 x 30 days =Rs. 1494.00
Net profit = Rs. 1494.00 – Rs. 420.00 = Rs. 1074.00

Cows (Winter)

Input Cost

(i) Extra fodder consumed @ 4.09 kg/day/animal x 6 animals
= 24.54 kg/day
Cost of 23.88 kg fodder = Rs. 6.13/day x 30 days= Rs. 183.90
(ii) Paddy straw bedding (10 kg) on alternate days
Rs. 10/day x 15 days = Rs. 150.00
Cost of labour (to remove paddy straw bedding/disposal)
0.25 man months/day@ Rs. 20/day = Rs.600.00
Total = Rs. 933.90

Output cost

(i) Increase in milk production @ 1.26 kg/day/animal x 6 animals
= 7.56 kg milk/day
7.56 kg x Rs. 10 (cost of milk/kg) = Rs. 75.60 x 30 days = Rs. 2268.00
Net profit = Rs. 2268.00 – Rs. 933.90 = Rs. 1334.00

Buffaloes (Hot-Dry Season)

Input Cost

(i) Extra fodder consumed @ 4.57 kg/day/animal x 6 animals
= 27.42 kg/day
Cost of 27.42 kg fodder = Rs. 6.85/day x 30 days = Rs. 205.50

Output Cost

(i) Increase in milk production @ 1.02 kg/day/animal x 6 animals
= 6.12 kg milk/day
6.12 kg x Rs. 14 (Cost of milk/kg) = Rs. 85.68 x 30 days =Rs. 2570.40
Net profit = Rs. 2570.40 – Rs. 205.50 = Rs. 2364.90

Buffaloes (Hot-Humid Season)

Input Cost
(i) Extra fodder consumed @ 4.15 kg/day/animal x 6 animals
= 24.90 kg/day
Cost of 24.90 kg fodder = Rs. 6.21/day x 30 days = Rs. 186.30

Output Cost

(i) Increase in milk production @ 0.92 kg/day/animal x 6 animals
= 5.52 kg milk/day
5.52 kg x Rs. 14 (Cost of milk/kg) = Rs. 77.28 x 30 days =Rs. 2318.40
Net profit = Rs. 2318.40 – Rs. 186.30 = Rs. 2132.10

Buffaloes (Winter)

Input Cost

(i) Extra fodder consumed @ 3.04 kg/day/animal x 6 animals
= 18.24 kg/day
Cost of 18.24 kg fodder = Rs. 4.56/day x 30 days = Rs. 136.80
(ii) Paddy straw bedding (10 kg) on alternate days
Rs. 10/day x 15 days = Rs. 150.00
Cost of labour (to remove paddy straw bedding/disposal)
0.25 man months/day@ Rs. 20/day = Rs.600.00
Total = Rs. 886.80

Output Cost

(i) Increase in milk production @ 0.76 kg/day/animal x 6 animals
= 4.56 kg milk/day

4.56 kg x Rs. 14 (cost of milk/kg) = Rs. 63.84 x 30 days = Rs. 1915.20
Net profit = Rs. 1915.20 – Rs. 886.80 = Rs. 1028.40

The modified management practices followed in this study during all seasons was remunerative and economical. Aii *et al*. (1988) reported that mist and fan system was economical when increase in daily milk yield per cow was more than 0.81 kg during hot-humid summers. In the present study, the increase in milk yield in cows was 10.23, 8.03 and 7.41 per cent during hot-dry, hot-humid and winter seasons, respectively as compared to control group. The corresponding values for buffaloes were 13.45, 13.27 and 9.44 per cent. Strickland *et al*. (1989) did the economic analysis of comparison between performances of cooled and uncooled cows, loose housed in an open sided barn in a hot-humid environment and indicated that sprinkler and fan cooling offered advantage in hot-humid climate. Lin *et al*. (1996) found barn with fan and mister system was the best system for cooling the cows during summer as compared to use of showers because water use and its wastage was less in mister system. However, cooling by air conditioning did not compensate for the cost of equipment by improvement in milk yield and reproduction (Vermeulen, 1988).

V

CONCLUSIONS AND RECOMMENDATIONS

Mist and fan use has been found to be quite economical as water use and its wastage is less in mister system as compared to water showers. The progressive farmers can use these without any adverse effect on the health of animals and incidence of mastitis. The entire cost of mister and fan can be recovered within a period of 3 months. In India, use of fan is common in dairies while use of coolers is negligible. For exotic breeds, cooling by air conditioning has been used on an experimental basis and was found to be uneconomical.

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