EFFECT OF SPRAY COOLING ON PHYSIOLOGICAL RESPONSES, BODY WEIGHT AND MILK YIELD OF CROSS-BRED COWS

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ABSTRACT

Twenty two normal lactating cross-bred cows (Holstein Friesian x Red Dane x Sahiwal) were randomly divided into 2 groups of 11 each. Group I was cooled by spray cooling for 3 min after an interval of every 12 min (15 min/hr) from 0900 to 1700 hrs in the months of June, July and August. Group II was kept as control. Rectal temperature and respiration rate were maintained in the cooled group while significantly increased in the control group at 1430 hrs than at 1000 hrs. Body weight increased in both the groups with the onset of rainy season but was maintained in the cooled group one month post-experimentation while there was a loss in body weight in the control during that period. High yielding cooled animals produced 8 per cent more milk than control in the experimental period. There was no effect of cooling milk yield in low yielders, and the decrease was similar to the control. Lower fat percentage was observed in the cooled (4.03±0.06%) compared to control (4.22±0.16%). It can be concluded that spray cooling increased physiological comfort, maintained body weight and arrested-decrease in milk yield in high yielding animals during hot climatic conditions.

INTRODUCTION

High yielding cows are susceptible to summer stress (Wise et al., 1988; McGuire et al., 1991) due to disturbed homeostasis (Patel et al., 1990; Bahga and Chaudhary, 1995). Various methods of amelioration of heat stress has been tried in cattle to improve performance during summer (Lough et al., 1990; Patel et al., 1990). Not much work has been done in lactating crossbred cows to ameliorate heat stress and increase production during summer. The present investigation was undertaken to study the effect of spray cooling on physiological comfort, body weight and milk production in high and low yielding triple crossbred cows.

MATERIAL AND METHODS

Twenty two normal lactating crossbred cows kept in semi-loose housing conditions were randomly divided into 2 groups of 11 each, keeping in view their parity, stage of lactation and milk yield. Group I was cooled from June through August by spray cooling system automatically controlled by an electronic timer and run for 3 min after an interval of every 12 min (15 min/hr) from 0900 to 1700 hrs (Fig. 1). Group II was kept as control. Rest of the standard farm management practices were adopted for both the groups. Meteorological observations like dry and wet bulb temperatures, relative humidity were recorded and temperature humidity index (THI) was calculated in hot-dry (June) and hot-humid (July-August) periods.

The cows were machine milked in the morning and evening (3 O’clock) in the milking parlour. Milk yield and fat percentage were recorded by weighing spring balance and electronic fat testing machine, respectively.

RESULTS AND DISCUSSION

a) Environmental modification and physiological norms: Spray cooling slightly improved the microclimate in the shed. The average THI in the control group was 82.57 while the value in the cooled group was 82.36 before cooling and 81.63 after cooling. The reason was that the shed was open on all sides.
Fig. 1. Layout plan of spray cooling system
with a lot of air circulation. The idea in the present investigation was also to directly cool the animal body instead of microclimatic modification in the shed. Cooling markedly improved thermal comfort of the animals. The cooled group maintained their rectal temperature 100.5 to 101.5°F and respiration rate 15-25 counts min⁻¹ at 1030 and 1430 hrs, respectively. In the control group, rectal temperature and respiration rates were lower at 1000 hrs (101.45±0.17°F and 17.35±0.23 counts min⁻¹) but were significantly (P<0.05) increased to 102.78±0.19°F and 32.71±5.27 counts min⁻¹ at 1430 hrs.

b) Body weight: Average body weight in the pre-treatment period (May) in the cooled and control groups were 424.80±25.57 kg and 460.00±18.66 kg, respectively. During the treatment period (July) body weights increased in both the groups to 432.30±24.90 kg in the cooled compared to 471.50±24.48 kg in the control. This might be due to onset of favourable rainy season and increased availability of forages. After the end of the experimental period (September), the cooled group continued to gain weight (439.57±31.15 kg) but there was loss of weight in the control group (457.57±29.91 kg). This might be due to the favourable residual effect of cooling and deleterious residual effect of heat stress in the control animals. This indicates that cooling helped to maintain animal health by increasing feed intake and/or assimilation.

c) Milk yield: To study the effect of cooling on milk yield, the animals were divided into 2 groups i.e. high yielding (>10 kg/day) and low yielding (<10 kg/day), respectively. Fortnightly average milk yield was calculated in both the groups. Pre-treatment milk yield values of second fortnight of May were taken as control in both the groups. The results were different in the high and low yielders. In the high yielders in the cooled group the decrease in milk yield in different fortnights (June through August) was from 3.29 to 18.40 per cent (av.11.19 per cent) while in the control group the decrease in the corresponding period was higher i.e. from 4.18 to 37.57 per cent (av. 19.04 per cent). In the low yielders cooling did not arrest the decrease in milk yield which was 11.67 to 33.40 per cent in the cooled compared to 6.46 to 30.92 per cent in the control group. Fat percentage was higher in the control (4.22±0.16) compared to the cooled (4.03±0.06) group.

From the results, it is evident that spray cooling had favourable effect on animal body in terms decreased respiration rate and rectal temperature, body weight maintenance and increased milk yield. Lower respiration rate and rectal temperature as a consequence of cooling has been reported in cow and buffalo (Pratt and Wetterman, 1986; Bahga et al., 1987; Bahga et al., 1998). Improved growth rate consequent upon microclimatic modification has been obtained in the present investigation. One of the reasons for low body weight in the heat stressed animals may be depressed basal metabolic rate (Swenson and Reece, 1993; Bahga and Chaudhary, 1995; Bahga and Parmar, 1998).

Cooling did not improve milk yield in low yielders due to their inherent capacity to produce less. Higher milk yield has been reported in high yielders in the cooled group compared to the heat stressed control. The reasons for decreased performance in heat stressed animals are due to decreased dry matter intake and net nutrient absorption (Beede and Collier, 1986; McGuire et al., 1991). In lactating cattle, thermal stress reduced dry matter intake from 5 to 25% depending upon its severity (Schneider, 1985). Decreased blood flow to mammary gland due to heat stress has been reported in lactating cows (McGuire et al., 1985; Lough et al.,
1990) and this might be the reason of lower milk yield in heat stressed cows. Lower fat percentage in the cooled group compared to control may be due to higher milk yield in the former as both these traits are negatively correlated.

It is concluded that spray cooling of high yielding (>10 kg) crossbred cows for 3 min after every 12 min (15 min/hr) from 0900 to 1700 hrs during hot climatic conditions (June - August) increased thermal comfort and resulted in 8 per cent increase in milk yield and maintained body weight. Further studies are warranted by changing the frequency and duration of the spray cooling.

REFERENCES