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Effect of microclimate alteration devices and feed additive on reproductive performance of Murrah buffaloes

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Abstract
The present study conducted to know the effect of microclimate alteration devices and feed additive on re productive performance of Murrah buffaloes in summer. Total 24 Murrah buffaloes were selected. They were distributed into randomized block design (RBD) as T_1 (foggers) T_2 (fans), T_3 (fans plus feed additive containing Chromisac (Chromium plus yeast) @ 500 g/ton of feed) and control. All the animals in groups were analysed for reproductive performance based on estrous signs, intensity of estrus, estrous response and duration of estrus. The present study revealed estrus response and duration of estrus was 66.66, 33.33, 33.33, 16.66 percent, and 23.8±6.2, 15.33±2.2, 16.3±0.8 and 13 hours in T_1, T_2, T_3 and control groups respectively. The present study concluded that reproductive performance is higher in T_1 and T_3 compare to T_2, and control. Hence foggers as microclimate alteration device was more advantageous compare to other.

Keywords: Murrah buffaloes, foggers, fans, Chromisac, reproductive performance

Introduction
India is largest milk producers and ranks first in the world. The per capita availability of milk in the country was 322 gram per day in 2014-15 (DAHD, GoI) [7]. The livestock sector is an important component of India's economy in terms of income, employment and foreign exchange earnings. As per the 19th Livestock Census [1], the total bovine population (Cattle and Buffalo) is 299.9 million. The Buffalo population in India is 108.7 million. India is a tropical country with hot and humid summer and relatively less stressful winter season. During summer (May-June), the atmospheric temperature goes as high as 45 °C during day time and 30 °C during night and photoperiod extends up to 12-14 hours. Global warming has a great impact on the reproductive activity of cattle and buffaloes. Global warming has risen the surface temperature by about 0.7 °C since the early 20th century. It is anticipated that the temperature rise will be 1.8-4 °C by 2100(IPCC, 2014) [9]. One of the great challenges faced by the farmers is the increasing temperature in summer. Stress factors stimulate the production and release of corticosterone (Siegel, 1995) [21]. Chromium is known to influence the secretion of corticosteroids and decrease sensitivity to stress. Chromium supplemented animals having reduced concentrations of cortisol in the blood (Pechova *et al*. 2002) [14]. Adverse effects of heat stress are impaired reproductive performance viz, the length and intensity of the estrus period and conception (fertility) rate, underdeveloped ovarian follicles (decreased size and growth) and greater susceptibility to diseases and environmental stress in bovines (Savsani *et al*. 2015) [18].
Yeast supplementation increases nutrient digestibility, alteration of the proportion of volatile fatty acids produced in the rumen, reduction in ruminal ammonia and increase of ruminal microorganism population (Chaucheyras *et al.* 2007) [5].
The sprinklers combined with forced air movement help increase the loss of body heat up to three-or four-folds. Foggers disperse very fine droplets of water which quickly evaporate and cool the surrounding air. If air flows over the animal with a velocity between 2 and 3 m/s, it increases convective heat loss during stressful conditions which can be achieved with air circulators (shearer *et al.* 1991) [20]. Since an attempt was made to know the reproductive performance of Murrah buffaloes in summer by microclimate alteration devices and feed additive at Livestock Research Station, Mamnoor.

Materials and Methods

The present investigation was undertaken at the Livestock Research Station (LRS), Mamnoor Warangal district from month of March to May, 2016 during summer when average temperature and THI ranged between 32-36 °C and 73-90, respectively and area is located in Central Telangana Zone (longitude 78° 49'' to 80° 43''E and latitude 17° 19'' to 80° 36''N).

Selection of Experimental animals

Twenty-four healthy and second stage of Murrah buffaloes were selected having similar body weight, parity. They were randomly distributed into four groups (T_1, T_2, T_3 and control) with six animals in each group in a randomized block design (RBD),

Experimental design

They were divided into four equal groups of six animals in each and given four different treatments and kept in head to head loose housing system. The first group (T_1) was housed with foggers operated daily during hot hour's from12:00 Noon to15:00 PM, the second group (T_2) was provided with ceiling fans (air circulating device) and third group (T_3) was housed with ceiling fans (air circulating device + feed additive), while the control group was not provided with cooling device or feed additive. The feed additive used is Chromium supplement blended with probiotics (yeast) @ 500 g per ton of feed. The particulars of the animals used for the experiment are furnished in Table 1.

Table 1: Details of experimental Murrah buffaloes

Treatment	Body Wt.	Parity	Stage of lactation (days)
T_1	520.17±4.59	2.17±0.17	41.2±5.64
T_2	515±5.34	2.17±0.17	38.33±10.83
T_3	516.33±2.23	2.50±0.5	38.00±9.05
Control	518.67±5.64	2.67±0.49	33.83±5.82

Management-Feeding and watering

All the experimental buffaloes were offered weighed quantities of chopped hybrid Napier (CO-4), kutti (chopped Jowar straw) and concentrate mixture to meet their dry matter requirements. Experimental buffaloes were offered with daily average 25 kg and 5 kg of hybrid Napier (CO-4) and kutti (chopped Jowar straw), respectively and the concentrate mixture was fed @ 1.5 kg/day/animal for body maintenance in general. Concentrate mixture was formed with Maize grain, Ground Nut Cake, Wheat Bran, Red Gram Chunny, Salt, Mineral Mixture and feed additive (chromisac) Table 2. The animals were provided balanced ration as per the recommendationsas per nutrient requirements of cattle and buffalo (ICAR2013) [8]. The details of ingredient composition of concentrate mixture are presented in Table 2.

AOAC (2012) [2] methods of analysis were followed for the determination of proximate principles of fodder and concentrate mixture.

Foggers

Foggers (BLUESTAL agri equipment) with four way anti-leak technology with nozzle size 0.5 mm and droplet size 80-100µ were used in the experimental sheds. The fogger system consisted of nozzles in a line placed 8 to 9 feet above the floor. This system disperses very fine water droplets and cools the air while raising the relative humidity.

Reproductive performance

Detection of Estrous

Onset of estrus was checked twice daily (morning and evening) by teaser-bull parading during the study period in all the four groups of experimental buffaloes and confirmed by examination of genitalia per rectum. Estrus was observed based on external manifestations such as bellowing, frequent urination, mounting other animals or being mounted by other animals in the pen, presence of mucus on vulva.

Duration of Estrous (hours)

Duration of behavioral estrous was estimated in hours from the time of first appearance of estrous to the time of detection of last estrous sign.

Intensity of Estrus

The intensity of estrus was measured as per the score card designed by Rao and Rao (1981) [15] with marginal modifications. The intensity of heat was classified as weak, normal and intense estrus (Table 1).

Estrus Response

The percent of estrus was calculated as number of buffaloes exhibited estrus divided by the number of animals in each group and multiplied by 100.

Statistical analysis

The data were analyzed using General Linear Model procedure of Statistical Package for Social Sciences (SPSS) 15th version and significance was considered at $P<0.05$ (Snedecor and Cochran, 1994) [23].

Results & Discussion

Results of present study are presented in this section. Chemical composition of feed is presented in Table 2. The per cent of crude protein in concentrate mixture is 16.87 on dry matter basis

Table 2: Composition of Concentrate Mixture

Concentrate Mixture	Percent
Maize grain	35
Ground Nut Cake	13
Coconut Cake	12
Wheat Bran	25
Red Gram Chunny	12
Salt	2
Mineral Mixture	1
feed additive	50g per 100 kg

Estrus Response

The estrus response was 66.66, 33.33, 33.33, and 16.66 percent in Foggers (T_1), Fan (T_2) Fan and Feed additive (T_3) and control, respectively. The estrus response was observed to be higher in fogger group than other groups (Table 4).

The estrus response observed to be highest in T_1 lowest in control. This might be due to decrease in heat stress in T_1 which might be responsible for increased ovarian activity resulting in estrus induction. The results were in agreement with Moghaddam (2009) [13] who also reported pregnancy rates of 56.7%, 40% and 23.3% in cows provided with sprinklers, fans and without sprinklers and fans, respectively. Soltan (2010) [24] concluded that Chromium supplementation at level of 6 mg/head/day improving reproductive performance as indicated by decrease the effect of heat stress in dairy cattle increased percentage of pregnant cows in the first 28 days of breeding.

Raizada and Pandey, (1981) [15], Thomas *et al*. (2005) [25] and Di Palo *et al.* (2009) [6] reported similar results in buffaloes in accordance with the present study.

Postpartum Estrus

Days taken for onset of estrus

The days taken for onset of first postpartum heat were in 101.7, 119.5, 116.30 and 128 days inT_1, T_2, T_3 and control, respectively (Table 4).

The number of days taken were more in control than treatment groups. The results were agreement with findings of Ryan *et al*. (1992) [17] where mean postpartum interval to pregnancy was117.6 days for evaporative cooling and 146.7 days for fans and sprayer cooling cows. Similar trend was observed by Chowdary (2003) [5] as in the present study. This might be due to buffaloes calving in late winter and early summer have lower reproductive efficiency compared to those calving during other seasons reported as by Singh and Nanda (1993) [22].

Estrus Duration

Results of present study revealed that the mean duration of estrus were 23.8±6.2, 15.33±2.2 and 16.3±0.8, 13 h in T_1, T_2, T_3 and control groups respectively (Table 4). Mean duration of estrus was longer in T_1 followed by T_2, T_3 and control.In present study estrous duration was decreased than normal it might be due to heat stress. Janakiraman, (1978) [10] and Bachalaus *et al*. (1979) [3] was observed shorter duration of estrous and poor estrous signs in buffaloes during summer are supported our results.

Estrus intensity

The intensity of estrus was intense, weak, weak, and weak estrus inT_1, T_2, T_3 and control, respectively (Table 4).

The average scale points for estrus intensity was higher in T_1 compared to other groups (Table 4). During the experimental period estrus symptoms were recorded and T_1 group showed more intense estrous. It might be due to sufficient level of estradiol hormone due to decreased heat stress resulted by foggers in T_1. However, low estradiol levels might be reason for weak in other treatments T_2, T_3 and control. The results are in accordance with Shafie *et al.* (1982) [19], Upadhaya *et al.* (2009) [26] who reported that low estradiol level on the day of estrous during summer period in buffaloes might be a factor for poor expression of heat in buffaloes.

Fig 1: Effect of microclimate alteration devices and feed additive on reproduction performance (%) of Murrah buffaloes.

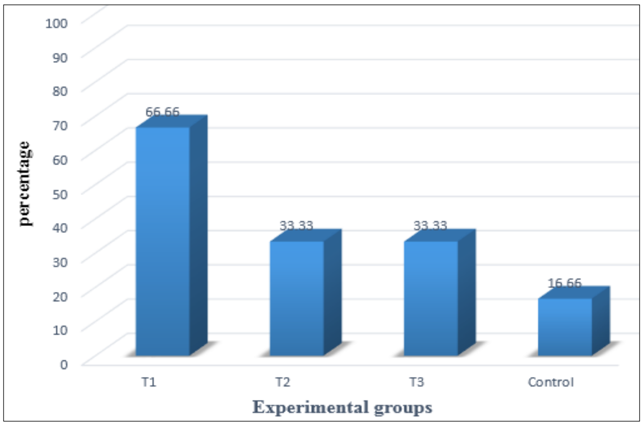

Table 3: Score card for assessment of estrus behavior in Murrah buffaloes

Symptoms exhibited	Points allotted
Bellowing	2
Excitement or restlessness	2
Estrual mucus discharge	3
Edema, congestion, wetness of vulva	3
Raising of tail in response to placing of palm on rump region	2
Micturition	2
Uterine tonocity	3
Cervical relaxation	2
Graffian follicle on the ovary	3
Temporary engorgement of teats	1
Decreased feed intake	1
Decreased milk yield	1
Total	25
Grading	
Weak estrus	<10 points
Normal estrus	10-15 points
Intense estrus	>15 points

Table 4: Effect of microclimate alteration on reproductive performance in Mrrah buffaloes during summer

S. No	Group	No. of animals in the group	Estrus response	No. of days taken to onset of estrous after calving (Mean)	Duration of estrous (H)	Grading (Intensity of heat)
1	T_1	6	4(66.66 %)	101.75	23.8±6.2	>15 points (Intense)
2	T_2	6	2(33.33%)	119.50	15.33±2.2	<10 points (weak)
3	T_3	6	2(33.33%)	116.30	16.33±0.8	<10 points (weak)
4	Control	6	1(16.66%)	128.00	13 h	<10 points (weak)

Conclusion

Present study concluded that the microclimate alteration devices foggers, fans and fans with chromium supplementation improving reproductive performance as indicated by decrease the effect of heat stress in buffaloes than control group.

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