# EFFECTS OF ENVIRONMENTAL AND ANIMAL FACTORS ON CONCEPTION RATE AT THE TIME OF INSEMINATION OF SHAHIWAL CATTLE IN DRY ZONE OF SRI LANKA.

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**ABSTRACT:** Study was conducted to assess the relationship of environmental and animal (cow) factors on conception rate at the time of insemination onSahiwal cattle and their crosses inBatticaloa District (dry zone) of Sri Lanka. Breedable female Sahiwal cattle and their crosses (204) were used in this study. All cows were artificially inseminated (AI) and selected 40 cows were used for the synchronization using PGF2α injection. Data on cow such as age, breed, parity, post-partum period (PPP) and milk yield were collected from the available records.Environmental temperature (ET), relative humidity (RH), rectal temperature (RT), respiratory rate (RR), body condition score (BCS), heat sign score and time interval between first detection of heat and the insemination were recorded at the time of insemination.Conception rate was assessed by per-rectal palpation at 90-120 days post insemination. The mean ± SD of the environmental temperature (ET) and the relative humidity (RH) at the time of insemination were 28.12 ± 2.08 $^{0}$C and 77.29 ± 5.64%, respectively. Environmental Temperature (ET) at the period of insemination was ($p<0.05$) negatively correlated with the relative humidity. The overall conception rate (57.25%) was effected by ET>29ºC, RH>85% and RT>38ºC. Cattle those were supposed to be with the BCS of 3 and the intense of heat signs and used for synchronization had higher conception rate ($p<0.05$). The results recommended that the conception rate of cattle is significantly affected by the hot thermal environment, poor energy nutrition and the management practices. Synchronization increases the possibility of heat detection. Hence, inseminating healthy cows during the high heat sign by the skilful AI technician under the suitable environmental condition can improve the conception rate in breedable cows.

**Keywords:** Artificial Insemination, Conception Rate, Sahiwal, Synchronization

## 1. INTRODUCTION

Several attempts have been made to improve the productivity of cattle breeds in Sri Lanka through the cross breeding programs. In order to achieve, theapplication of AI has made one of the significant impacts in animal agriculture. Although, the productivity of cattle in dry zone of Sri Lanka still remains far from the satisfactory level.Many factorswhich affect the conception rate have been documented well in the previous studies. Further, conception rate (CR) is influenced by several factors related to the cow, bull or artificial insemination and the farming system. In addition to the environmental factors, management also influence a lot on the conception rate (Gwazdauskas *et al*., 1975). Reports from the field and laboratory experiments denotes that the conception rate in cows is negatively related with the environmental temperature and humidity (Gwazdauskas *et al*., 1973). Increasing heat stress during the oestrus and following insemination have been shown to increase in the rectal temperature (Gwazdauskas *et al*., 1973) and the respiration rate (Mundia and Yamamoto, 1997) of the cows. Poor performance in reproduction associated with thermal stress, may be due to high rectal temperature acting directly on the developing embryo (Gwazdauskas *et al*., 1973).

In addition, conception rate has an inter-relationship with cow factors including the level of milk production, Body Condition (Domeco, *et al*., 1997) and postpartum period (Perera, 2000). Relationship of management factors such as time of insemination (Juster *et al*., 1981) and skill of inseminator (Hunter and Greave, 1998) with the conception rate have been

shown quite contribution. Therefore, present study was designed with the overall objectives in order to identify the inter-relationships among the environmental and animal parameters on the conception rate at the time of insemination on the breedable Sahiwal Cows and their crossesin Batticaloa District (dry zone) of Sri Lanka.

## 2.MATERIALS AND METHODS

### 2.1Location and Animal

Study was conducted during the period of January 2014 to January 2015in Batticaloa District where two hundred and four breedable female Sahiwal cattle and their crosseswere randomly selected from the dairy farmers of the selected study location.

### 2.2 Oestrus Synchronization

Randomly selected cows were ensured for its normal physiological body conditions and were subjected to oestrus synchronization. Synchronization process were carried out by injecting 2ml of PGF2α(Estroplan, Australia)at the appropriate time. Then the animals were closely monitored for their heat signs. Inseminations were done after 2-3 days of injection. Further, semen fromthe Sahiwal stud bulls were used to inseminate the selected cows in this studywhere only one AI technician was supposed to engage with this insemination techniques.

### 2.3 Data and Measurements

Cow data such as age, parity, post-partum period and milk yield were collected from the available records. And also, Rectal Temperature (RT), Respiratory Rate (RR), Body Condition Score (BCS) andthe time interval between first detection of heat and the insemination were measured at the time of insemination. Environmental temperature and relative humidity of the environment were recorded by using dry and wet bulb thermo metre. RT was measured by using digital thermo metre.RR was estimated by visual monitoring of chest and abdominal movement of the experimental cows. Body Condition Score of the cows was assessed with a range of 1-5 based on the thickness of subcutaneous fat layer covering the body. Heat signs shown by the cows were observed by visual observation at the time of insemination. The intensity of heat signs was also observed at the time of insemination.

All animals were closely monitored for re-exhibition of the heat symptoms between 18-20 days, after the insemination. In addition, pregnancy diagnosis was done at 90 days, after the insemination. Conception was confirmed by per rectal palpation. Data were statistically analysed using categorical data analytical procedure of statistical analysis system.

## 3. RESULTS AND DISCUSSION

### 3.1 Environmental Parameters

The mean ± SD of the Environmental Temperature (ET) and the Relative Humidity (RH) at the time of insemination of 204 cows were 28.12 ± 2.08$^0$C (Range 24.20$^0$C - 32.5$^0$C) and 77.29 ± 5.64% (Range 67% - 87%), respectively. Moreover, Relative Humidity (RH) fluctuated in an opposite directional manner with the ET.

### 3.2 Cow Information

Overall mean value of the age, parity, Post-PartumPeriod (PPP), daily milk yield of cattle at the time of insemination were 4.72 ± 2.20 years, 1.61 ± 1.44, 204.36 ± 145.44 days and 6.57 ± 2.66 litres per day, respectively. Most of the cattle were within the age category of 3.5-6.5years and were recognised as heifers. Higher number of animals were in between 0-200 PPP, while majority of animal the produce was around 4.5-8.5 litres milk/day.

### 3.3 Physiological Parameters

Mean ± SD of body temperature and Respiration Rate (RR) at the time of insemination were 37.89 ± $0.93^0$Cand 14.5 ± 1.39 breaths per minutes, respectively.Environmental Temperature (ET) during the insemination was negatively correlated to the Relative Humidity (RH) ($p<0.01$, $r = -0.83$, Table 1). However, cow factors were not significantly correlated with the environmental temperature and the relative humidity. Because, data exhibited that the high individual animal variation resulted from the measurements which were taken from the different times of the day.

*Table 1: Relationship Among The Environmental Parameters and Animal Parameters*

| | ET | RH | Parity | Milk yield | body Temperature |
|---|---|---|---|---|---|
| ET | | | | | |
| RH | -.826** | | | | |
| Parity | 0.087 | -0.22 | | | |
| Milk yield | -0.139 | 0.21 | -0.132 | | |
| Body temperature | 0.279 | -0.232 | -0.034 | -0.268 | |
| BCS | -0.146 | 0.093 | 0.046 | 0.154 | -0.232 |

### 3.4 Environmental Parameters and Conception Rate

Environmental Temperature at the time of insemination was significantly associatedwith the conception rate ($p<0.05$) of the cows. Above $29^0$C of the ET, the conception rate was declined where significant changes were obtained within the range of $28^0$C – $30^0$C. Hence these results agreed with the report of Gwazdauskas *et al*., (1973) where high environmental temperature causes the lower conception rate and influnced highly on embroyonic loss, in dairy cattle. Heat stress causes the depression in progesterone secretion secreted by the corpus luteum and decreases thyroid activity prominent to loss of body condition and low conception and it also decreases estrogen and lutenizing hormone (LH) secretion (Badinga *et al*.,1985). Relative humidity at the time of insemination was significantly associatedwith the conception rate ($p<0.05$). Majority of the insemination was done in between 70-85% of the relative humidity. However, the highest percentage of the conception was attained at the range of relative humidity in between 80-85%. And also, the conception rate was declined while the relative humidity exceeding(above 85%). Relationship of ET and RH with the conception rate was highly pronounced under hot thermal conditions. Conception rate (CR) with ET and RH, increased above $29^0$C and 85% and it was suggested with the adverse effect of increased heat load on cattle.

### 3.5 Rectal Temperature and Conception Rate

Rectal temperature was significantly correlated with the conception rate ($p<0.05$) of the cows. Here, previous studies were supported with the poor performances in reproduction and associated with the thermal stress which may be due to high rectal temperature acting directly on the developing embryo, as well (Gwazdauskas *et al*., 1973). Previously stated (Dunlap and Vincent, 1971) that an inverse relationship between body temperature and the conception rate. Further, Thatcher *et al*., (1985) reported that the Conception rate declined due to the thermal stress and caused the inability to maintain normal body temperature in animals. Other possible reason reported by Michel, (1998) that reduced viability of oocyte and early embryo due to the insufficient production of heat shock protein developed due to the elevated temperature.

### 3.6 Body Condition Score (BCS) and Conception Rate

BCS was significantly associated with the conception rate ($p<0.05$) and around 51 % of the cows had BCS of 3. Lower conception rate was exposed in cows which hadthe BCS < 3 and it was obvious that the cows were in negative energy balance. These results supported the following finding reports. Domecq *et al.,* 1997 reported that such poor and loss of BCS at insemination, had negative influence on the conception in cattle. Abegunawardena and Abegunawardena(1998) reported that over feeding to cattle leads to delayed uterine involution, difficulty at calving, and postpartum uterine infection. In addition, Brusell*i et al*., (2001) reported that a positive correlation between BCS at calving and conception rate especially while the BCS is in between 3 to 4.5.

### 3.7 Heat sign Score and Conception Rate

Heat sign score was significantly related with the conception rate ($p<0.05$). Further, there was a chance to achieve high possibility of conception rate in animal which showed more than one heat sign in often. These findings agreed with the finding report where thepoor expression of heat has been recognized as contributory factor to lower conception rate in cattle (VanEerdenburg*et al*., 2002). Thatcher *et al*., (1985) reported that concentration oestrogen and progesterone affect the blood flow to reproductive tract and its micro environment, which control the gamete transport, capacitation, fertilization and development of embryo.

### 3.8 Timing of Insemination Related to First Detection of Heat and Conception Rate

Time interval at the onset of first detection of heat and AI ranged from 0.5 to 12.5 hours, respectively. Highest number of insemination was performed 0.5 to 3.5 hoursinterval and higher conception rate also was achieved with the time range of 6.5-12.5 hours. However, present study had no any significant relationship among heat detection, AI and the conception rate.Further, it was recorded positively in previous studies where thetime interval from heat detection and AI showed significant relationship with the conception rate.

### 3.9 Synchronization and Conception Rate

Conception rates of synchronized and non-synchronized cows were 62.5% and 52%, respectively. Higher conception rate was achieved in synchronized cows than non-synchronized cows. This result agreed with the findings of Lajili, *et al*., (1991) who reported that PG F2α treatment prior to GnRH injection had a major influence on the conception rate (CR was increased from 40- 60%, $p < 0.01$). PGF2α destroy the Corpus Luteum (CL) on the ovaries that are in Days 6- 16 of their oestrous cycles. In other words, the injection

decreases the function of the CL which allows these females to return to oestrus within 2-5 days to facilitate the conception rate (Lajili, *et al*., 1991).

### 3.10 Conception Rate

The overall conception rate of study was around 57.25%. This value was higher than the reported value (47.6%) by Gwasdauskas (1975). This higher conception rate could be achieved due to skill of inseminator and better timing of insemination under the suitable environmental conditions.

## 4. CONCLUSION

The results of study indicated that conception rate of cattle was affected by hot thermal environment, poor energy nutrition and management practices. Synchronization increase the possibility of heat detection. Hence, inseminating healthy cows with high heat sign by skilful AI technician under suitable environmental condition will result in higher conception rate in cattle.

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