

Effect of seasons on days open of breeding cows

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ABSTRACT

Objective: to evaluate the effect of seasons on days open and calving date of breeding cows of the Cristo Rey cattle ranch, San Andres Tuxtla, Veracruz based on 15-years records.

Design/Methodology/Approach: using 15 years of production records from the Cristo Rey cattle ranch, the relationship between date of calving and next breeding was analyzed to obtain the days open (number of days defined from calving to next conception). Data used were the most recent calving date, and next breeding date. Based on calving date cows were classified into four seasonal calving groups, then the days open (calving interval) for each cow were quantified. Descriptive statistics of calving intervals were used to obtain a frequency distribution, and an analysis of variance with InfoStat[®] was used to determine differences among calving intervals, also to determine if days open were associated with calving per season.

Results: a total of 985 calving events were recorded, with an overall average of 240 days open. Only 15.8% of the breeding cows had less than 103 days open. The highest percentages were counted between 104 and 358 days open. It was also recorded that 17 cows took more than a year and a half (≥ 528 days open) to breed again. With a significant difference among seasons ($p=0.0003$), winter was identified as the season in which the cows that calved had the fewest days open (219).

Limitations/Implications of the study: a correlation analysis between calving and breeding was not performed in two cycles. However, the identified trend is an approximation to the usefulness of performing such correlations as a further step.

Findings/Conclusions: breeding and calving do not occur synchronously in the same herd. This is due not only to the calving intervals in each season, but also to other nutritional, health, and genetic factors that influence the date of breeding and calving in the same year or the following year.

Keywords: seasons, days open, breeding.

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INTRODUCTION

Bovine reproduction is a multifactorial process influenced by diverse environmental conditions that can affect both the physiology and productivity of animals (Góngora and Hernández, 2010). Mexico is a country with significant climate diversity. Environmental effects on days open of cows are relevant, especially in tropical and subtropical regions. High temperature and relative humidity, plus the seasonal variations can induce thermal stress on animals that affects reproductive capacity. All of which may result in very long calving intervals, this is, greater numbers of days open between calving and the next breed (Cordova, 2017).



In tropical regions, such as southern Veracruz (Mexico), climate conditions, especially temperature and humidity, significantly affect the reproductive physiology of cows inducing heat stress (Arias and Escobar, 2008). Previous studies have shown that an increase in ambient temperature alters ovarian function, estrus, embryonic development, birth, and affects semen quality; (Brito *et al.*, 2002; Vergara, 2018). This type of stress not only affects reproductive activity, but also affects behavior, decreased food intake, and the overall health of the animals. All of those are factors that have effects on days open (Bustillo Parrado and Melo Colina, 2020).

Despite growing concern about this phenomenon, research on the specific effects of the environment on days open and calving of cows in southern Veracruz remains limited. This study aimed to evaluate the effect of seasons on days open and calving date of breeding cows of the Cristo Rey cattle ranch (San Andres Tuxtla, Veracruz) based on 15-years records.

MATERIALS AND METHODS

This study was conducted at the “Cristo Rey” cattle ranch, located in the community of ‘El Popotal’, municipality of San Andres Tuxtla (Veracruz) Mexico, at coordinates 18.236058 N and -95.289757 W (Figure 1). The local climate is predominantly warm sub-humid according to the modified Köppen classification (García, 2004), with approximately 1282 mm of annual average rainfall and 25.7 °C average temperature. Soils are clayey in texture, classified as Vertisols. Topographically, terrain relief are plains, although there are low areas saturated with residual moisture (CONAGUA, 2024).

An Ombrothermal diagram of the area was graphed with 30-years data of monthly average temperature and monthly average rainfall in the study area. January to May are the drier months in the year, with the greatest amount of rainfall concentrated between June and October (Figure 2).

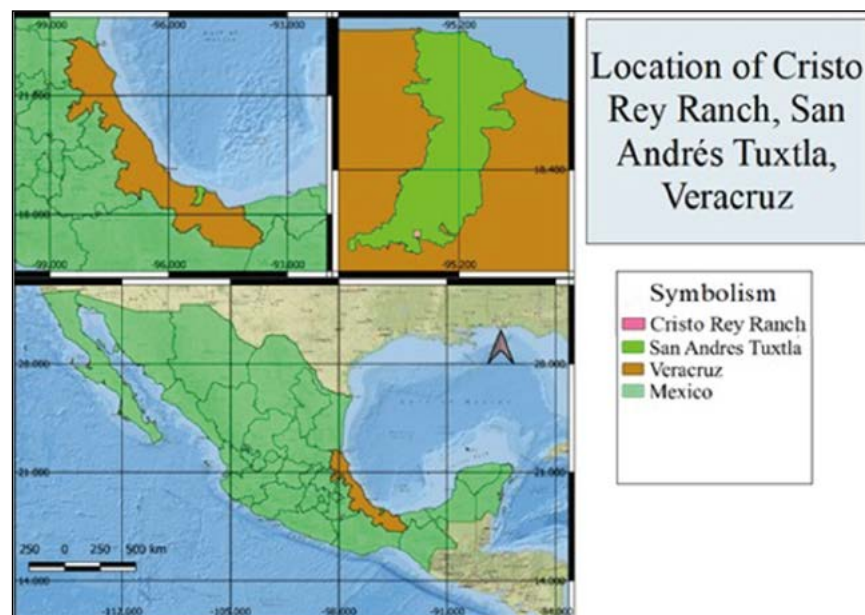


Figure 1. Location of the study area; San Andres Tuxtla (Veracruz), Mexico.

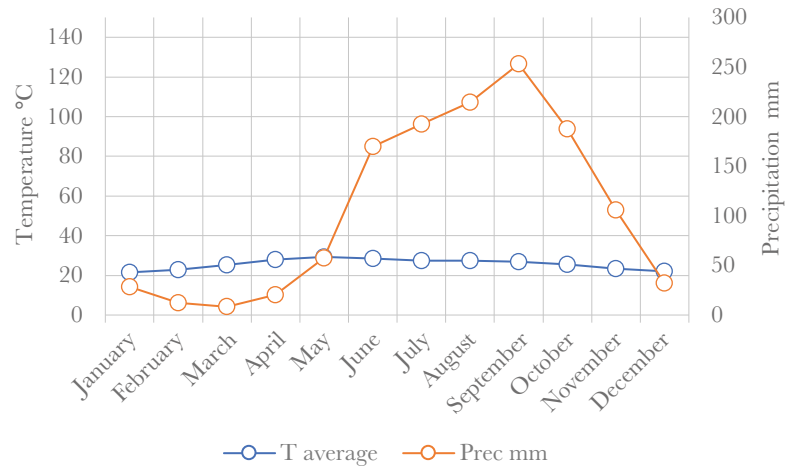


Figure 2. Ombrothermal diagram, based on normalized (1991-2020) climate data for ‘El Popotal’, San Andres Tuxtla (Veracruz) Mexico. Source: CONAGUA (2024) database.

The production system of the Cristo Rey cattle ranch can be classified as a livestock farm dedicated to the production of breeding stock, with natural mating. Breeds managed are American Swiss (*Bos taurus*), Gyr (*Bos indicus*) and their cross breeds. The grazing system is rotational; in December, January and February, a feed supplement of sugarcane silage (*Saccharum officinarum*) is offered to animals. Staff follows a vaccination schedule; they administer vitamins, and deworm the animals; also, they provide free access to mineral salts. Female calves born are destined for breeding, and male calves are sold as livestock.

Variables evaluated

The study consisted of two stages; first stage was the collection of records at the livestock farm, 15-year data (2009-2024). Second stage was the design and performing of analytics (Figure 3).

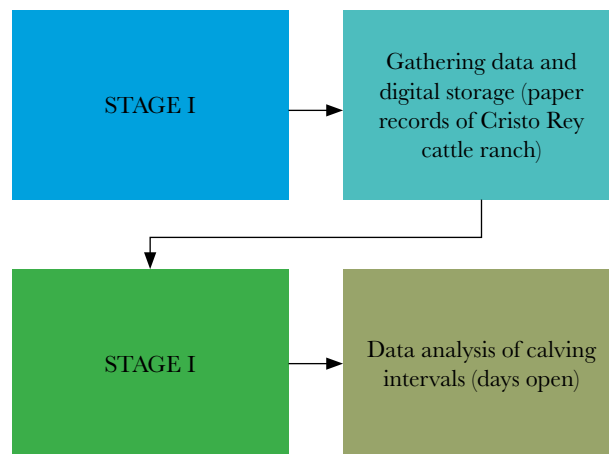


Figure 3. Work flowchart of the study conducted at Cristo Rey cattle ranch, San Andres Tuxtla (Veracruz) Mexico.

Stage 1. Collecting and classifying production records

Excel[®] spreadsheets with 15 years of records from the Cristo Rey ranch were compiled. Calving date and next conception date per cow were the data used to obtain the days open. Data were classified according to the latest calving date and the season in which that occurred. With the data, four groups of cows were categorized by calving in each season (winter, spring, summer, and autumn) to explore relationships between season and the number of days open for each cow.

Stage 2. Data analysis

With the data grouped by season, a descriptive analysis of the days open was done. We obtained the frequency distribution, then we performed an analysis of variance using InfoStat[®] to determine whether there was a difference among the days open in each group, then if that was the case, finding which group took the shortest time (fewer days open) until the next breeding.

RESULTS AND DISCUSSION

A total of 985 births were recorded over 15 years. During this time, cows averaged 240 days open as overall calving interval to subsequent breeding. This is a higher number than that reported by Ríos *et al.* (2020), 162 days open for Zebu×European cows under tropical conditions. However, the mode of the data is 160 days open. Another interesting fact is that some cows presented more than 500 days open. This finding is consistent with other studies indicating that long calving intervals have negative consequences on the productivity and profitability of livestock systems. According to Cerri *et al.* (2009), long calving intervals (greater number of days open) are associated with lower reproductive efficiency rates, which can lead to lost revenue due to lower calf production. In our case, prolonged periods without breeding could reflect problems in fertility or reproductive management. This circumstance requires attention to avoid significant economic costs (Table 1).

Only 15.8% of cows had less than 103 days open, which means less than four months passed before they bred again. Higher percentages were concentrated between 104 and 358 days open. There were 17 cows which took more than a year and a half (≥ 528 days open) to breed again. This pattern could suggest that, although most cows breed within a reasonable timeframe, a significant fraction of them face challenges that lengthen this period. Thus, a thorough review of reproductive management protocols is required, which could include among others, improving estrus synchronization, optimizing nutrition, and controlling diseases associated with reproduction (Figure 4).

The analysis of variance showed significant difference ($F_c=2.614$, $p\leq 0.0003$) in days open per season. With the results of the mean comparison test of days open, for the four groups according to season, it is observed that the group of cows that calved in winter presented the shortest calving interval ($\bar{x}=219$ days open, $p\leq 0.05$). In contrast, cows that calved in autumn had longer calving intervals ($\bar{x}=263$ days open; $p\leq 0.05$), though these were statistically similar to the groups of cows that calved in spring and summer (Table 2).

Table 1. Descriptive statistics for calving interval of cows in the ‘Cristo Rey’ ranch, San Andres Tuxtla (Veracruz) México, 2009-2024 records.

Calving interval (days open)		
Mean	\bar{x}	239.554
Standard Error of the Mean	$S_{\bar{x}}$	4.170
Median		225.500
Mode		159.500
Standard Deviation	s	130.895
Sample Variance	s^2	17133.753
Kurtosis		0.295
Skewness Coefficient		0.630
Class Interval		848
Lower Limit		18.500
Upper Limit		866.500
Sum		235961.500
Cows that calved	n	985
Typical error (uncertainty)	u	0.0174

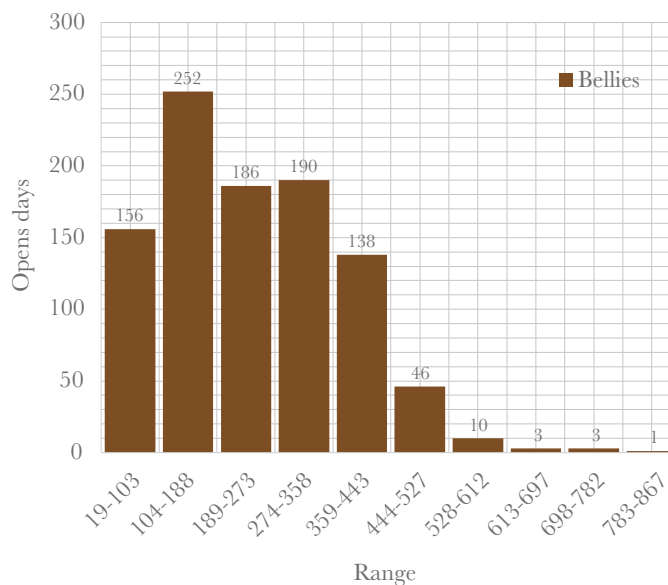


Figure 4. Frequency distribution of days open recorded over 15 years in San Andres Tuxtla, Veracruz. Source: Cristo Rey cattle ranch, 2009-2024 records.

Another important fact is that in winter occurred the most calving events, while summer was the season with the fewest. Seasonality in reproduction is a commonly observed phenomenon in many livestock systems. However, the low number of calving events recorded in summer could also indicate that those cows faced suboptimal prior seasonal conditions, which limited their ability to breed efficiently (Domínguez *et al.*, 1987).

Table 3 shows how next breeding by season reflect on calving by season. For example, autumn is the time with the fewest number of conceptions recorded, also with the greatest

Table 2. Seasonal difference in calving interval (days open) of cows of the ‘Cristo Rey’ ranch in San Andres Tuxtla, Veracruz, México (2009-2024).

Season	Mean	n	SEM	HSD
Winter	218.87	381	6.65	A
Spring	243.16	247	8.26	B
Summer	250.77	113	12.22	B
Autumn	263.01	244	8.31	B

Mean comparison test; n: cows that calved in season; SEM: Standard Error of the Mean; Honest Significant Difference, HSD=25.242 ($p \leq 0.05$); degrees of freedom, d.f: 981.

Table 3. Observed trend between calving (per season) and subsequent conception of cows in the ‘Cristo Rey’ cattle ranch, San Andres Tuxtla, Veracruz, Mexico (2009-2024 records).

Season	Calving	Mean of days open	Next conception	Season of next breeding
Winter	381	218.87	238	Spring-summer
Spring	247	243.16	392	Summer-autumn
Summer	113	250.77	245	Autumn-winter
Autumn	244	263.01	110	Winter-spring

number of days open, and this effect is reflected on calving in the following summer. With adequate monitoring, we can add up the days open of the season (in this example, autumn) then infer that those cows would breed again between winter and spring.

The fewer number of days open in winter may be due to the feed supplementation with sugarcane, ground maize, and mineral salt implemented by the ranch staff at the end of December. Therefore, this nutritional management may have an effect on reducing days open in cows (Pires *et al.*, 2011). Furthermore, for the geographic area where the study area is located, average 23 °C temperatures are reached in winter, and 49 mm of accumulated rainfall (CONAGUA, 2024), both maintaining conditions for pasture recovery.

Under the situation shown, we can observe that not all cows will calve in the same season, since their calving intervals (days open) determine their estrus and consequently the season of next calving (in a cyclical rhythm). Therefore, a cow will calve in different seasons throughout its productive life.

CONCLUSIONS

The results of this study highlight the importance of season on days open of cows at the Cristo Rey ranch. Days open (meaning shortest calving interval) during the winter season were statistically fewer than those during other seasons. Likewise, seasonal days open (in addition to genetic, nutritional, and health factors) influence the date of conception and, consequently, the date of calving.

Since each cow can breed and calve in different season, appropriate management during seasons of greater stress can help decreasing calving intervals and improve livestock productivity. Identifying those factors that influence on days open is crucial to improve the profitability and long-term sustainability of cattle production.

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