The Pharma Innovation Journal 2023; 12(3): 01-04

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(3): 01-04

www.thepharmajournal.com
Received: 01-12-2022
Accepted: 05-01-2023

Ricardo Avilés-Ruiz
Las Huastecas Research Station, CIRNE, National Institute of Forestry, Agricultural, and Livestock (INIFAP) Altamira, Tamaulipas 89610, Mexico

Oscar Guadalupe Barrón-Bravo
Las Huastecas Research Station, CIRNE, National Institute of Forestry, Agricultural, and Livestock (INIFAP) Altamira, Tamaulipas 89610, Mexico

Miguel Ruiz-Albarrán
Faculty of Veterinary Medicine and Zootechnics "Dr. Norberto Treviño Zapata", Autonomous University of Tamaulipas Victoria City, Tamaulipas 87274, Mexico

Rubén Darío Garza-Cedillo
Río Bravo Research Station, CIRNE, National Institute of Forestry, Agricultural, and Livestock (INIFAP), Río Bravo, Tamaulipas 88900, Mexico

Corresponding Author:
Ricardo Avilés-Ruiz
Las Huastecas Research Station, CIRNE, National Institute of Forestry, Agricultural, and Livestock (INIFAP) Altamira, Tamaulipas 89610, Mexico

Parity affects calving interval in dual-purpose cattle in the Mexican tropics

Ricardo Avilés-Ruiz, Oscar Guadalupe Barrón-Bravo, Miguel Ruiz-Albarrán and Rubén Darío Garza-Cedillo

Abstract
The aim of this study was to calculate the calving interval and reproductive efficiency by the effect of parity in a dual-purpose herd in the Mexican tropics. The prospective observational study of the cows´ reproductive records from the year 2013 to 2021 was analyzed. The records with reproductive pathology and non 50% *Bos indicus* and 50% *Bos taurus* were taken out. In total, 67 intervals between calving of 24 cows were gotten from a farm in the Mexican tropics. The genotypes were 50% *Bos indicus* (Gyr) genes and the remaining 50% genes came from Holstein, Fleckvieh, and Brown Swiss. A linear model as a simple design of fixed effect was used. The mean calving interval was 485 ± 121 days. Parity factor had an effect on the calving interval. The correlation between these two variables was - 0.46 (p<0.01). In conclusion, parity affected the calving interval in this dual-purpose cattle herd; parity is proportional inversely to the calving interval. 60% reproductive efficiency was obtained.

Keywords: Calving number, bovine, anestrous postpartum, reproductive efficiency, reproduction

Introduction
Dual-purpose cattle production systems are mainly distributed in tropical humid and tropical dry climate region in Mexico. At these tropical latitudes the growth of natural vegetation depends mainly on rainfall (González-Padilla *et al*., 2019). Crosses of the *Bos primigenius* species, the subspecies *Bos primigenius indicus* (Zebu: Gyr and Brahman,) and *taurus* (European: Swiss, Holstein, and Fleckvieh) are used in tropical regions in Mexico (Ríos-Utrera *et al*., 2020) [2].

Prolonged postpartum anestrus directly affects reproductive efficiency in the intensive dairy system (Butler, 2003) [3] and in dual-purpose systems in Mexico (Rojo-Rubio *et al*., 2009; Lassala *et al*., 2020) [4-5]. Postpartum anestrus is the period of time from parturition to the reestablishment/resumption of ovarian activity postpartum or to the first estrus with ovulation (Peter *et al*., 2009; Vallejo-Timarán *et al*., 2020) [6-7]. Thus, the return of the postpartum reproductive stage occurs when the cow presents a cycle estrous with ovulation and viable oocyte. However, it has been shown that the main factors that determine the duration of postpartum anestrus in dual-purpose cattle are undernourishment (Avilés-Ruiz *et al*., 2022) [8], the calf´s bond with its dam (Orihuela and Galina, 2019) [9], the calving season, and the parity or calving numbers (Hernández-Reyes *et al*., 2000). Regarding the latter, it has been found that cows that give birth too young take longer to present the first postpartum estrus. This is because the reproductive cows' organs continue to develop (Báez and Grajales, 2009) [11]. Moreover, they present a deeper negative energy balance and they use their energy reserves to continue their development (Barry *et al*., 2006) [12]. Therefore, the aim of this study was to calculate the calving interval (CI) and reproductive efficiency by the effect of parity in a dual-purpose herd (*Bos indicus* x *Bos taurus*) in the Mexican tropics.

Materials and Methods
The study was carried out with the reproductive records of a small-scale dual-purpose cattle farm, located in the community in the municipality of Aldama, Tamaulipas, Mexico, which is located at 22 °83 " North latitude and 98 °11 " West latitude and an altitude range of 50-1,200 meters above sea level with a range rainfall of 900-1100 mm per year. This place has a tropical climate with a range of 18-26 °C. The hottest month is June and the coldest is January. There are three distinct seasons of the year: the dry season (from March to June), the rainy season (from July to October), and the windy season (from November to February; INEGI, 2009) [3].

The animals were grazed and supplemented with commercial minerals. The cows were milked one time per day at 8:00 A.M. The cows in production, in addition to grazing, were fed with commercial concentrated (1-2 kg/day; 18% CP). The calves´ suckling was controlled. The cattle reproduction was carried out by artificial insemination. The ADE-Forte® (Twice/year), Bobact® (Once/year), Acatak®, Derrienfine® (Twice/year) were administrated to animals as a preventive sanitary management of the herd.

The information from the farm corresponding to the reproductive performance records from the year 2013 to 2021 was analyzed. 67 calving intervals of 24 cows were gotten.

The calving interval (CI) was estimated as the difference in days between two successive calvings and the calving to conception interval was equal to CI menus the pregnancy time (282 days).

Only genotypes with 50% *Bos indicus* genes and the remaining 50% genes came from Holstein, Fleckvieh, and Brown Swiss were chosen and the records with reproductive pathology were taken out.

The CI had a normal distribution and to evaluate the variation factor (parity) on CI. A linear model as a simple design of fixed effect was used. The model design was the following:

$$Y_i = \mu + Parity_i + E_i$$

Where:
Y_i = was the i-th observation of CI
μ = overall mean
$Parity_i$ = effect of i-th parturition number
E_i = effect of residual error

The differences between CI means were determined by Duncan's Test (95% confidence level). The correlation was analyzed with the Pearson Test. Simple linear regression was carried out in Microsoft Excel® program and the rest of the analyses were in the Statgraphics plus version 5.1® (Herndon, VA).

Results

Calving Interval

A CI of 485±121 days was obtained (Table 1). Nevertheless, the CI was calculated according to parity, where it was found that the probability of a cow having a higher CI, and therefore a greater number of open days, increases as the parity (calving number) increases. In addition, there was a moderate (P = 0.0001) negative correlation between the parity and the CI (r = - 0.46; n = 67), which means a higher parity lower CI on each cow (Figure 1).

Table 1: Effect of parity on calving interval (days) of dual-purpose cattle (*Bos indicus* x *Bos taurus*) in the Mexican tropics.

Parity	n	Calving Interval Mean ± SD (days)
1	24	540±132 [c]
2	14	521±112 [cb]
3	12	445±89 [ba]
>4	17	407±83 [a]
General mean	67	485±121

Note: The mean value with different superscript in the same row differed significantly (P = 0.0013)

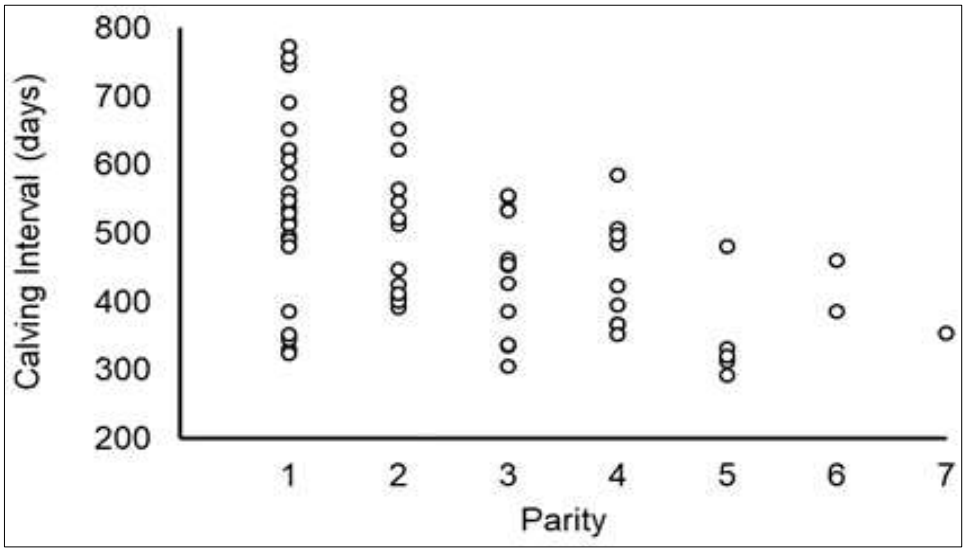

Fig 1: Pearson correlation between parity and calving interval of dual-purpose cattle (n = 67; P = 0.0001).

In the present study, a linear regression was found, in which the equation showed a negative trend (Figure 2).

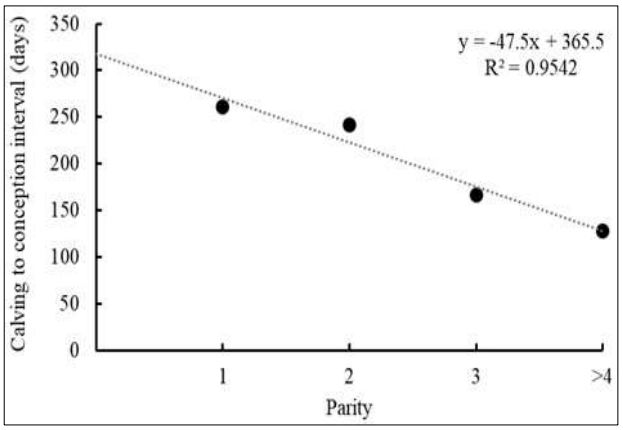

Fig 2: Prediction of the time from calving to conception interval and their trend according to the parity of dual-purpose cattle.

Reproductive Efficiency

General mean of 485±121 days of CI was obtained, if the mean gestation length (282 days) was subtracted from this data, the mean of calving to conception interval for this herd was obtained, which was 203 days. The mean of calving to conception interval was divided by 30 days on average for the month, which gave us 6.77 months. Obtained in months the mean of calving to conception interval, which was 6.77, subtracted the 3 months that the bibliography suggests from the time interval from calving to the cow becoming pregnant again, a loss of 3.77 months / animal was particularly obtained for this herd. The number of cows studied (24) was multiplied by previous loss, obtaining a total of 90.4 months, which multiplied by 30 days (to obtain the value in days), resulted in 2,712 days. Finally, this result was divided by the average duration of a gestation (282 days) resulting in 9.62, which is the number of calves that were lost per year. This represented 40% of lost calves / year, thus an efficiency of 60% was obtained for this studied herd without considering the reproductive pathology records.

Discussion

Regarding CI, it had been reported that dual-purpose F1 Holstein x Gyr cows from 234 lactation records that were properly managed from Brazilian herd showed 106 days and 383 days of calving to conception interval and CI, respectively (da Costa *et al*., 2020) [14]. Those were distant from that obtained in Mexico and especially from the present study, probably due to the handling of the animals, since the progenitors of these animals underwent genetic evaluations to commercialize doses of semen.

The reproductive parameters more evaluated in dual-purpose cattle in Mexico are: long CI and low fertilization percentages (Rojo-Rubio *et al*., 2009) [4]. The general mean obtained for the CI was 485 days, higher than that found by Arce *et al*. (2017) [15] and Ríos-Utrera *et al*. (2020) [2] who obtained a mean of 427 and 448 days, respectively for the *Bos taurus* X *Bos indicus* crosses. It was also higher than what is indicated for dual-purpose systems in tropical conditions, which recommends an optimum mean of less than or equal to 420 days (Román *et al*., 2009) [16]. However, it is a common value for tropical conditions, where the calf spends an average period of 7 months with the mother (Garay-Martínez *et al*., 2020) [17], and the suckling lengthens the period of postpartum anestrus and the CI, due to the inhibitory effect that the suckling has on ovarian activity (Rojo-Rubio *et al*., 2009; Arce *et al*., 2017) [4, 15].

Another study (Arellano *et al*., 2006) [18] clearly showed how to predict the CI that cows will have as parity increases by means of a linear regression model reported by this group of researchers. It is important to say that in a prior study, as our study, it was carried out in a region with the same climate. Furthermore, they worked with the following racial groups: Swiss-Cebu, Swiss-Holstein, Cebu-Holstein, and Swiss.

Regarding reproductive efficiency (Lassala *et al*. 2020) [5], it was pointed out that establishing the reproductive efficiency of a herd only by calving rate is not true, since this parameter is also affected by factors that include age at first calving, pregnancy rate, and cow and bull fertility, among others. However, reproductive traits generally have low genetic heritability, making management of environmental factors important for the successful production of weaned calves. Moreover, they found little adoption of reproductive management practices in Mexico in cow-calf systems and as the implementation and promotion of technologies associated with reproduction in bovines denotes an area of opportunity to improve the reproductive efficiency of herds at the national level. In fact, the reproductive efficiency for the tropical dual-purpose herds in Mexico was 50 to 60% (Magaña *et al*., 2006) [19]. The prior data was according to the present study.

Conclusions

Parity affected the calving interval in dual-purpose cattle herd, the higher the parity, the shorter the time between calving and pregnancy and it obtained a reproductive efficiency of 60%.

Acknowledgments

The authors wish to thank Dr. Sergio De los Santos Valadez for providing the records of his cattle herd.

References

1. González-Padilla E, Lassala A, Pedernera M, Gutiérrez CG. Cow-calf management practices in Mexico: Farm organization and infrastructure. Veterinaria México 2019;6:1-17. https://doi.org/10.22201/fmvz.24486760e.2019.3.677
2. Ríos-Utrera Á, Villagómez-Amezcua E, Zárate-Martínez JP, Calderón-Robles RC, Vega-Murillo VE. Análisis reproductivo de vacas Suizo Pardo x Cebú y Simmental x Cebú en condiciones tropicales. Revista MVZ Córdoba 2020;25:e1637. https://doi.org/10.21897/rmvz.1637
3. Butler WR. Energy balance relationships with follicular development, ovulation and fertility in postpartum dairy cows. Livestock Production Science. 2003;83:211-218. https://doi.org/10.1016/S0301-6226(03)00112-X
4. Rojo-Rubio R, Vázquez-Armijo JF, Pérez-Hernández P, Mendoza-Martínez GD, Salem AZM, Albarrán-Portillo B, *et al*. Dual purpose cattle production in Mexico. Tropical Animal Health Production. 2009;41:715-721. https://doi.org/10.1007/s11250-008-9249-8
5. Lassala A, Hernández-Cerón J, Pedernera M, González-Padilla E, Gutiérrez CG. Cow-calf management practices in Mexico: Reproduction and breeding. Veterinaria México. 2020;7:1-15. http://dx.doi.org/10.22201/fmvz.24486760e.2019.3.677

6. Peter AT, Vos PLAM, Ambrose DJ. Postpartum anestrus in dairy cattle. Theriogenology. 2009;71:1333-1342. https://doi.org/10.1016/j.theriogenology.2008.11.012
7. Vallejo-Timarán D, Reyes-Vélez J, VanLeeuwen J, Maldonado-Estrada J, Astaiza-Martínez J. Incidence and effects of subacute ruminal acidosis and subclinical ketosis with respect to postpartum anestrus in grazing dairy cows. Heliyon. 2020;6:e03712. https://doi.org/10.1016/j.heliyon.2020.e03712.
8. Avilés-Ruiz R, Barrón-Bravo OG, Alcalá-Rico JSGJ, Salinas-Chavira J, Flores-Nájera MJ, Ruiz-Albarrán M. Deficiencias nutricionales que afectan al reinicio de la ciclicidad posparto en bovinos doble propósito. Abanico Veterinario. 2022;12:1-21. http://dx.doi.org/10.21929/abavet2022.251
9. Orihuela A, Galina CS. Effects of separation of cows and calves on reproductive performance and animal welfare in tropical beef cattle. Animals. 2019;9:223-236. http://doi.org/10.3390/ani9050223
10. Hernández-Reyes E, Segura-Correa VM, Segura-Correa JC, Osorio-Arce MM. Intervalo entre partos, duración de la lactancia y producción de leche en un hato de doble propósito en Yucatán, México. Agrociencia. 2000;34:699-705. https://www.redalyc.org/articulo.oa?id=30234604
11. Báez G, Grajales H. Anestro posparto en ganado bovino en el trópico. Revista MVZ Córdoba. 2009;14:1867-1875. http://www.scielo.org.co/pdf/mvz/v14n3/v14n3a11.pdf
12. Berry DP, Veerkamp RF, Dillon P. Phenotypic profiles for body weight, body condition score, energy intake, and energy balance across different parities and concentrate feeding levels. Livestock Science. 2006;104:1-12. https://doi.org/10.1016/j.livsci.2006.02.012
13. INEGI Prontuario de información geográfica municipal de los Estados Unidos Mexicanos. Aldama, Tamaulipas. Clave geoestadística. 2009, 28002. https://www.inegi.org.mx/contenidos/app/mexicocifras/datos_geograficos/28/28002.pdf
14. Da Costa MD, Dos Reis AF, Mendes-Ruas JR, Bispo GE, Rocha-Júnior VR, Mesquita-Gomes V, *et al*. Productive and reproductive performance of females F1 Holstein x Gir daughters of proven bulls. Tropical Animal Health Production. 2020;53:10. https://doi.org/10.1007/s11250-020-02462-9
15. Arce C, Aranda EM, Osorio MM, González R, Díaz P, Hinojosa JA. Evaluación de parámetros productivos y reproductivos en un hato de doble propósito en Tabasco, México. Revista Mexicana de Ciencias. Pecuarias 2017;8:83-91. https://doi.org/10.22319/rmcp.v8i1.4347
16. Román H, Ortega L, Hernández L, Díaz E, Espinoza JA, Nuñez G, *et al*. Producción de leche de bovinos en el sistema doble propósito. Libro Técnico Núm. 22. INIFAP.CIRGOC. Veracruz, México. 2009;121-144. https://www.uv.mx/veracruz/cienciaanimal/files/2013/11/Produccion-de-leche-de-bovinos-en-el-sistema-doble-proposito.pdf
17. Garay-Martínez JR, Barrón-Bravo OG, Maciel-Torres SP, Avilés-Ruiz R, Joaquín-Cancino S, Bautista-Martínez Y, *et al*. Caracterización de las unidades de producción de bovinos en El Mante, Tamaulipas. Ciencia e Innovación. 2020;3:113-124.
18. Arellano S, Martínez J, Romero E, Briones F, Domínguez M, De la Garza F. Factores genético-ambientales que afectan el intervalo entre partos y días a primer parto en ganado de doble propósito en el norte de Veracruz. Avances en Investigaciones Agropecuarias. 2006;10:29-41. http://www.redalyc.org/articulo.oa?id=83710104
19. Magaña JG, Ríos G, Martínez JC. Los sistemas de doble propósito y los desafíos en los climas tropicales de México. Archivos Latinoamericanos de Producción Animal. 2006;14:105-114. https://ojs.alpa.uy/index.php/ojs_files/article/view/493