https://doi.org/10.61308/GPRM5789

Influence of the sire on the reproductive parameters of Limousin cows

Svetoslav Karamfilov
Agricultural University, Department of Animal Science, 4000 Plovdiv, Bulgaria
Corresponding author: steven0531@abv.bg

Citation: Karamfilov, S. (2025). Influence of the sire on the reproductive parameters of Limousin cows. *Bulgarian Journal of Animal Husbandry, 62*(4), 3-10

Abstract: The aim of the study was to examine the reproductive characteristics of 152 Limousin cows, reared in a farm on the territory of Southwest Bulgaria. The records about the reproductive capacity of cows used in the survey comprised the period 2016 - 2024. The cows, whose differences were studied, were born in Bulgaria and France. The Limousin cows, reared in the conditions of our country, had an average service period duration of 85.66 ± 3.51 days, and a calving period of 370.68 ± 3.18 days. The first-calving age was 34.21 ± 0.26 months. The animals achieved optimum service (70.58 ± 9.33 days), and calving (355.85 ± 12.14) periods as early as during their first lactation, which is indicative of a good reproductive capacity. The sire, the origin and the lactation number had a significant influence ($p< 0.05$) on the length of the service and the calving periods. The sire and the country of birth had a significant influence ($p<0.001$) on the first-calving age. The daughters of 33% of the sires had a service period of up to 80 days, and 40 % of the sires had daughters with calving periods of up to 368 days. The cows born in Bulgaria, had a service period of 83.71 ± 4.94 days, and a calving period of 368.71 ± 4.05 days. The animals born in France, had 99.80 ± 15.18 service days, and a calving period of 373.01 ± 6.19 days.

Keywords: Limousin; reproduction; influence; sire; origin

INTRODUCTION

The effective management of the beef cattle reproductive processes contributes to the enhancement of the economic benefits and the sustainable production of calves (Li et al., 2025). The seasonal calving in a particular season is what is mostly practiced in the beef cattle herds, but it requires good reproduction organization and well prepared, and healthy animals with regular cyclicity (Diskin and Kenny, 2016). The influence of the breed and its ability to reproduce sustainably in different conditions, such as temperature changes, levels of nourishment or resistance to diseases, are stably increasing in importance (Bayssa et al., 2021). In the recent years assisted reproductive technologies have been effectively used in the beef cattle herds, as they provide the opportunity for genetic enhancement, reduction in the risks of disease transmission, fertility increase, and proper reproduction planning (Lamb et al., 2026; Andrade et al., 2024). In line with the reproductive methods applied, the wellbeing of the cattle is closely observed as an important indicator, connected to the successful reproduction (Ritter et al., 2019). The reproduction organization and the fertility increase, are both connected to a combination of factors, which have influence: breed, season of calving, farm, postpartum recovery period, feeding, etc. (Izquierdo et al., 2021; Titterington et al, 2017). Different types of influence on the reproductive capacity under different production systems have been observed and analysed (Fernandez-Novo et al., 2020). Europe continues to be the main beef producer, and the French beef breeds continue to be among the most preferred for farming under different production conditions (Grimard et al., 2017; Hocquette et al., 2017). Different studies on the cattle breeds with very good production and reproductive capacity point to Limousine, as the one which is chosen, as such by a plethora of farmers (Vertsé-Zándoki et al., 2021). Currently, the stud-

ies in the field of Limousin reproduction in our country are largely insufficient. The aim of this study was to examine the reproductive capacity of Limousin cows of different origin, reared in the conditions in Bulgaria. We also set ourselves the task to differentiate the influence of some factors, and to record the reproduction of the daughters of particular sires used.

MATERIALS AND METHODS

The study included 152 Limousin cows, reared in a farm on the territory of Southwest Bulgaria. The animals were under the selection control of „National Association for Beef Cattle Breeding in Bulgaria" - Sofia. The cows were reared intensively in free groups in a semi-open building. During most of the year, from April to November, they used a pasture, located close to the farm. The cows conceived naturally with the use of bulls. The calvings were in tours - mostly during the autumn and the spring months. The suckling period of the calves was 210 days. In our study, we used the reproductive capacity records with reference to cows, which had given birth within the period 2016 - 2024. The reproductive capacity reported was that of cows with different origin and a country of birth Bulgaria (N-83) and France (N-69). The sires (N-15) had a similar French origin by lineage, and a different one in terms of country of birth- Bulgaria, Austria, Germany, France, Ireland, Luxemburg. The animals subject to the analysis were from their first to their ninth lactation. During the statistical processing, the age of 22 months was taken as the first-calving age. As for the calving interval, the records used were for a period not longer than 520 days. The methods used for the calculation of the reproductive capacity were in compliance with the ICAR (2018) recommendations, regarding the beef farming, as well as with the approved Limousin breeding practices in Bulgaria. The data were processed via analysis of variance and the linear model has the following expression: $Yijk = \mu + Fi + Oj + Lk + eijk$; where Yijk- observation vector, μ- total average constant; Fi- fixed effect of the sire (i=15), Oj- fixed effect of the country of birth of the mother (j= 2; Bulgaria and France), Lk- fixed effect of the lactation number (k=9), eijk- residuals. The data were statistically processed via the program SPSS, version 21 and presented in tables and figures.

RESULTS AND DISCUSSION

Limousin cows in our study had an average service period length of 85.66 ± 3.51 days, and a calving interval of 370.68 ± 3.18 days. 53.28 % of the animals had a service period of up to 80 days after calving, and a calving period of up to 365 between the calvings. The country of birth (origin) the lactation number and the sire (Table 1) had a significant influence ($p<0.05$) on the duration of the service period of Limousin cows.

The factors, which had significant influence ($p<0.05$) on the cows calving interval, were the origin, the lactation number and the sire. Similar and significant ($p<0.001$) was the influence of the sire and the country of birth on the first-calving age. In a study of (Titterington et al., 2017), it was ascertained that the breed of the sire had a significant influence ($P<0.001$) on the first calving period of the cows. What was observed in the conditions of our country was a relative variation in

Table 1. Influence of some factors on the reproductive capacity of Limousin cows

Factor	Service period	Calving period	Age of first calving
Father	2.152*	2.002*	5.677***
Consecutive calving	2.461*	3.735*	-
Country of birth (origin)	4.512*	4.813*	25.985***

****p<0.001; **p<0.01; *p<0.05*

the service and the calving periods of daughters of different sires (Table 2).

The daughters of 33 % of the sires had a service period of up to 80 days after calving. The daughters of 27 % of the sires conceived 100 days post calving, with the maximum service period reported being 111.33 ± 19.95 days. As a whole, taking the conditions of our country into account, it can be claimed that that Limousin cows in our study had an optimum service and calving interval periods. In beef cattle, the length of the independence and service periods is influenced by a number of factors such as: suckling of the calf, lactation number, ease of parturition, diseases etc. (Damiran et al., 2018; Yavas and Walton, 2000; Washaya et al., 2025). In our study, it was observed that the daughters of 20 % of the sires had a service period of between 51 and 55 days. This is indicative of the quick recovery of the reproductive cycle, connected with the post parturition processes. The daughters of 53 % of the sires had a service period between 70 and 100 days. The greatest variation in the service period SD - 73.23 days, was reported for the daughters of sire № 10, and the lowest - SD 14.94 days, was reported for the daughters of sire № 8. The results regarding the calving period were similar to those reported for the service period. The daughters of 40 % of the sires had a calving period within 368 days between their calvings. The remaining 60 % of the sires had daughters, which had calving periods of over 365 days, and the longest one recorded was 396.33 days. It could be stated that the cows had an excellent reproductive capacity as for the reproductive parameter 'calving interval', because they gave birth to a calf annually. Brzáková et al. (2020) reported a calving interval of 381 days for beef cows in the Czech Republic. The first-calving age of Limousin cows observed by us was 34.21 ± 0.26 months. The cows born in Bulgaria had a first-calving age of 33.81 ± 0.39 months, and those with French origin- 34.52 ± 0.42 months. The first-calving age had a negative genetic correlation with the number of calvings per cow's lifetime (- 0,29), and a positive correlation (0,14) with the calving period. (López-Paredes et al., 2018). In our study, it was observed that the minimum first-calving age was

Table 2. Influence of the father on the service and calving periods of Limosin cows reared in Bulgaia

Sire	N	Service period			Calving period		
		LS	Sx	SDev	LS	Sx	Sdev
1	16	77.69	7.51	29.09	362.69	7.51	34.16
2	5	91.40	20.63	41.26	376.40	20.63	38.05
3	47	86.66	6.12	41.52	371.66	6.12	44.21
4	6	102.00	16.38	36.62	387.00	16.38	34.59
5	12	111.33	16.95	56.22	396.33	16.95	52.73
6	6	87.67	8.52	19.04	372.67	8.52	21.18
7	5	73.20	13.85	27.71	358.20	13.85	29.54
8	6	53.50	6.68	14.94	338.50	6.68	19.91
9	4	54.75	15.07	26.09	339.75	15.07	28.55
10	6	93.00	32.75	73.23	378.00	32.75	64.91
11	10	99.80	15.18	45.55	384.80	15.18	49.03
12	5	105.80	34.33	64.66	390.80	34.33	68.46
13	11	51.91	6.15	19.44	336.91	6.19	17.76
14	6	83.00	26.33	58.88	368.00	26.33	47.82
15	7	102.00	13.79	33.77	387.00	13.79	37.04
Total	152	85.66	3.51	43.21	370.68	3.18	43.13

24 months, and only 2,7 % of the animals gave birth for the first time between 24 and 25 months old. (Czerniawska-Piątkowska et al., 2012) ascertained that the first-calving age of Limousin cows in Poland was 1082 ± 177.21 days on average, and their calving period was 457 ± 163.13 days, which is older age than that reported for first calving in our study. In Italy (de Rezende et al., 2020), Limousin cows had a first calving age of 1101.84 ± 236,21 days. The sire had a significant influence ($p<0.05$) on the first-calving age of the daughters reared in Bulgaria (Table 3).

Bene et al. (2021) reported that in Hungary, the first-calving age of Limousin cows was 34,7±0,4 months, and the value has exhibited a downward trend by decreasing by 0,33 months annually in the recent years. The authors received results similar to ours, with reference to the significant influence of the sire (6,74 %) on the parameter. In our study, 73 % of the sires had daughters with age of first calving between 33 and 38 months, and the daughters of 40 % of the sires became first-calf heifers aged 34-35 months old. The daughters of sire № 10 had the lowest age of first calving- 30.77 ± 2.62 months, and at the same time, they exhibited the greatest variation of the respective parameter SD - 5.86. The daughters of sire № 2 were reported to have the highest first-calving age of 37.77 ± 0.64 months, however, they did not display any deviations from the optimum values regarding their service and calving periods. It can be noted that the age difference between the age of first calving of the daughters of sire № 10 and sire № 2 was seven months, and their service and calving periods were similar. The daughters of 13 % of the sires, which had a first-calving age between 30 and 32 months old, had longer service period of above 100 days, and a calving period of over 385 days. In general, the sires used had daughters with age of first calving, which could be considered optimum for the breed. This subsequently ensures well developed animals with an optimum growth and development, perfectly prepared for an uncomplicated first lactation. As early as during their first lactation, Limousin cows achieve optimum service (70.58 ± 9.33 days) and calving (355.85 ± 12.14 days) periods, which is indicative

Table 3. Influence of the sire on the age of first calving of Limousin cows reared in Bulgaia

Sire	N	Age of first calving, month		
		LS	Sx	SDev
1	16	32.93	0.92	3.57
2	5	37.77	0.64	2.13
3	47	33.98	0.52	3.54
4	6	34.92	0.76	1.70
5	12	32.70	0.86	2.86
6	6	35.01	0.71	2.27
7	5	34.74	1.46	2.91
8	6	35.86	0.95	2.19
9	4	35.93	0.58	1.76
10	6	30.77	2.62	5.86
11	10	37.20	0.49	1.46
12	5	36.89	1.15	2.30
13	11	33.37	0.31	0.98
14	6	35.13	0.36	0.80
15	7	31.85	0.51	1.25
Total	152	34.21	0.26	3.22

of the good reproductive capacity of the young animals (Fig. 1).

The longest service and calving periods were reported for the oldest cows in the study, and the shortest - for the cows at their fourth lactation. The cows at their second lactation had a service period, which was 12.5 days longer than that of the cows at their first lactation. The difference between the service period of the cows between their fourth and eight lactations was 42 days. The trend observed during the first three lactations was towards an increase of the service and calving period by 17.4 days on average. Similar trend, but with prolonging the periods with 22.3 days was observed, between the sixth and the eighth lactation. (Twomey and Cromie, 2023) reported that with the increase of the lactation number of the beef cows, the calving period decreases ($P<0.001$). The authors are of the opinion, that the early first service is connected to a reduced commercial use and lower productivity of the cows. During the period of our study, the cows had relatively stable reproductive parameters with similar variations between the subsequent lactations. Within their first lactation, 35 % of the cows had a service period of 50 days, and 20 % had a service period between 50 and 100 days. 63.6 % of the first- time heifers had a first calving period between 310 and 368 days for the respective lactation. The first calving period for Limousin cows in Great Britain (Moore et al., 2018) was 424 days, and the age of first calving was between 25 and 36 months. The first-calf heifers had more difficult parturitions, and recovered more slowly than the older cows. In our study, we ascertained that as early as during their third lactation, 75 % of the animals conceived up to 100 days after calving, and 54.1 % had a calving period with duration of 365 days. Within their fourth lactation, 77.8 % of the cows achieved an excellent reproductive capacity with a service period of up to 82 days after calving, and a calving period of up to 367 days. (Guminskaya et al., 2021) report the best reproductive parameters for Limousin cows aged between 5 and 9 years. The average service period length of the cows born in Bulgaria was 83.71 ± 4.94 days, and that of the calving period- 368.71 ± 4.94 days (Fig. 2). The daughters of sires № 13 and № 8 born in Bulgaria had service period which was around 90 days shorter than that of the daughters of sire № 5. Within the country of birth, it was observed that sire № 5 had daughters, which were born in France, and they achieved service period with an optimum duration (Fig. 3).

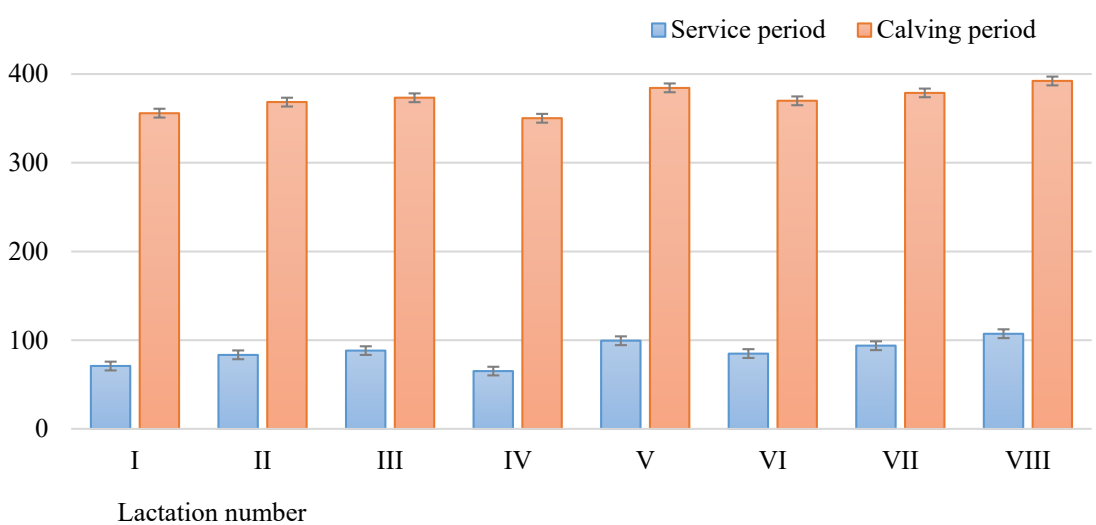

Figure 1. Service and calving periods of Limousin cows at different lactation

When the daughters of sire № 1 were compared within the origin, those cows born in France had calving and service periods, which were 21.42 days shorter than those of the same sire daughters, born in Bulgaria. The Bulgarian - origin daughters of 42.8 % of the sires had service periods of up to 80 days and calving periods of up to 365 days. The daughters of 28.5 % of the sires had service periods of over 100 days after calving, and calving periods of above 390 days. The shortest calving period was reported for the daughters of sire № 13, and the longest- for the daughters of sire № 5, with the difference of 90.7 days. The average length of the service period of the cows born in France was 88.0 ± 5.01 days, and that of the calving period- 373.71 ± 6.19 days.

The cows born in France displayed similar reproductive capacity to that of the animals born

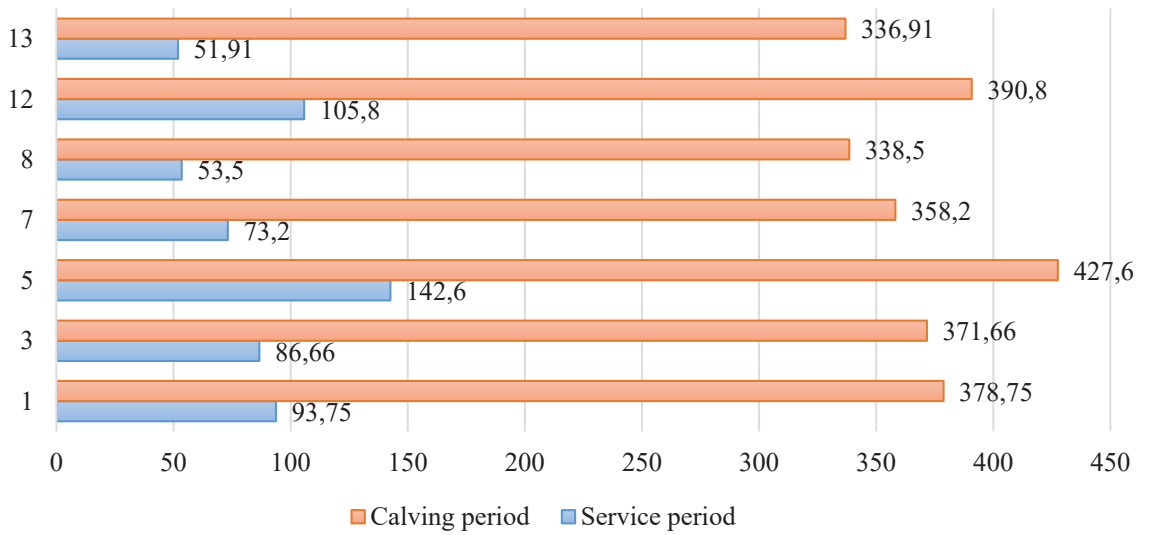

Figure 2. Service and calving periods of Limousin cows born in Bulgaria

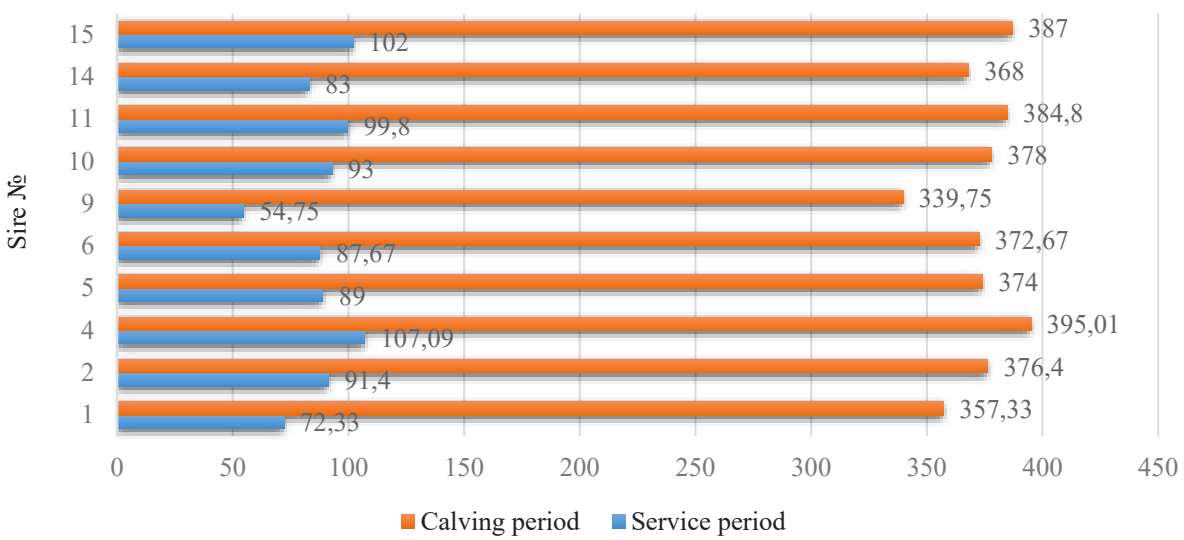

Figure 3. Service and calving periods of Limousin cows born in France

in Bulgaria, and the origin had a significant influence on the parameters examined. According to (Grimard et al., 2017), the cows from the beef herds reared in France, had a calving period between 379 and 444 days depending on the breed. In our conditions, the France - born daughters of 20 % of the sires had a service period of up to 80 days, and a calving period of up to 365 days. The daughters of 60 % of the sires had a service period between 80 and 100 days, and a calving period between 365 and 385 days. The cows born in France were successfully serviced within an optimum period post calving, and they also achieve similar calving period. The shortest service period was displayed by the daughters of sire № 9, and the longest- by those of sire № 4, with the difference of 52.34 days. The biggest variation in the calving period was exhibited by the daughters of sire № 10 (SD- 73.23), and the lowest- by the daughters of sire № 6 (SD- 19.4). No service periods shorter than 50 days were reported for any of the daughters of both origins.

CONCLUSION

Limousin cows reared in the conditions of our country had a service period length of 85.66 ± 3.51 days, and a calving interval length of 370.68 ± 3.18. The age of first calving was 34.21 ± 0.26 days. The service period of the cows at their first lactation was 70.58±9.33 days, and their calving period was 355.85±12.14 days, which is indicative of their good reproductive capacity. The animals with Bulgarian origin had a service period of 83.71±4.94 days and a calving period of 368.71± 4.05 days. The cows born in France had a service period of 99.80 ± 15.18 days and a calving period of 373.01 ± 6.19 days. The father, the origin and the lactation number had a significant influence ($p<0.05$) on the length of the service and the calving periods. Significant influence ($p< 0.001$) on the age of first calving was exercised by the sire and the country of birth. The daughters of 33 % of the sires had service period of up to 80 days, and 40 % of the sires had daughters with a calving period of up to 368 days. When selecting breeding bulls suitable for the conditions in our country, it is necessary that attention be paid on the breeding values for the parameters, connected to the reproductive characteristics of daughters, reared in Bulgaria.

REFERENCES

Andrade, J. P. N., Monteiro, P. J., Prata, A. B., Robl, A. J., Neto, J., Lippe, B. & Wiltbank, M. C. (2024). Optimizing ReBreed21 II: Fertility and reproductive efficiency in different parities during a shortened breeding season in beef cattle. *Theriogenology*, *224*, 41 - 49.

Bayssa, M., Yigrem, S., Betsha, S. & Tolera, A. (2021). Production, reproduction and some adaptation characteristics of Boran cattle breed under changing climate: A systematic review and meta-analysis. *PloS one*, *16*(5), e0244836.

Bene, S., Polgár, P. J., Szűcs, M., Márton, J., Szabó, E. & Szabó, F. (2021). Environmental effects, population genetic parameters, breeding value, phenotypic and genetic trend for age at first calving of Limousin cows. *Journal of Central European Agriculture*, *22*(2), 240 - 249.

Brzáková, M., Čítek, J., Svitáková, A., Veselá, Z. & Vostrý, L. (2020). Genetic parameters for age at first calving and first calving interval of beef cattle. *Animals*, *10*(11), 2122.

Czerniawska-Piątkowska, E., Szewczuk, M., Chociłowicz, E. & Konstancik, N. (2012). Comparison of Limousin and Simmental primiparous cows based on the variability of age at first calving, body weight and the analysis of their growth and development. *Electronic J. Polish Agric. Univ. Ser. Anim. Husbandry*, *15*(7).

Damiran, D., Larson, K. A., Pearce, L. T., Erickson, N. E. & Lardner, B. H. (2018). Effect of calving period on beef cow longevity and lifetime productivity in western Canada. *Translational Animal Science*, *2*(suppl. 1), S61 - S65.

de Rezende, M. P. G., Malhado, C. H. M., Biffani, S., Carneiro, P. L. S., Carrillo, J. A. & Bozzi, R. (2020). Genotype-environment interaction for age at first calving in Limousine and Charolais cattle raised in Italy, employing reaction norm model. *Livestock Science*, *232*, 103912.

Diskin, M. G. & Kenny, D. A. (2016). Managing the reproductive performance of beef cows. *Theriogenology*, *86*(1), 379 - 387.

Fernandez-Novo, A., Pérez-Garnelo, S. S., Villagrá, A., Pérez-Villalobos, N. & Astiz, S. (2020). The effect of stress on reproduction and reproductive technologies in beef cattle - A review. *Animals*, *10*(11), 2096.

Grimard, B., Agabriel, J., Chambon, G., Chanvallon, A., Constant, F. F. & Chastant-Maillard, S. (2017). Reproductive characteristics of French beef cattle breeds. *INRA Productions Animales*, *30*(2), 125 - 138.

Guminskaya, E. Y., Sidunov, S. V., Loban, R. V., Sidunova, M. N., Lebedev, N. A., Lupolov, T. A. & El Battawy, K. (2021). Regulation of the Limousine cows' and Heifers' Reproductive Function. In *IOP Conference Series: Earth and Environmental Science*, *852*, 1, 012034.

Hocquette, J. F., Ellies-Oury, M. P., Lherm, M., Pineau, C., Deblitz, C. & Farmer, L. (2018). Current situation and future prospects for beef production in Europe—A review. *Asian-Australasian journal of animal sciences*, *31*(7), 1017.

Izquierdo, A. C., Reyes, A. E. I., Lang, G. R., Oaxaca, J. S., Liera, J. E. G., Mancera, E. A. V. & Sánchez, R. S. (2021). Nutrition and Food in the Reproduction of Cattle. *European Journal of Agriculture and Food Sciences*, *3*(3), 21 - 33.

Lamb, G. C., Mercadante, V. R. G., Henry, D. D., Fontes, P. L. P., Dahlen, C. R., Larson, J. E. & DiLorenzo, N. (2016). Invited Review: Advantages of current and future reproductive technologies for beef cattle production1, 2. *The Professional Animal Scientist, 32*(2), 162 - 171.

Li, Z., Liu, H., Wang, J., Zhou, Y., Fang, Y. & Lu, W. (2025). Retrospect and prospect: reproductive technologies in beef cattle. *Molecular Biology Reports*, *52*(1), 1 - 11.

López-Paredes, J., Pérez-Cabal, M. A., Jiménez-Montero, J. A. & Alenda, R. (2018). Influence of age at first calving in a continuous calving season on productive, functional, and economic performance in a Blonde d'Aquitaine beef population. *Journal of animal science*, *96*(10), 4015 - 4027.

Moore, K. L., Moran, A., Mrode, R. & Coffey, M. (2018). Using Commercial Data and Genomics to Improve Female Fertility and Calf Survival of Limousin beef cattle in the UK. In: *Proceedings of the World Congress on Genefics Applied to Livestock Producfion,* 11, 65.

Ritter, C., Beaver, A., & von Keyserlingk, M. A. (2019). The complex relationship between welfare and reproduction in cattle. *Reproduction in Domestic Animals*, *54*, 29 - 37.

Titterington, F. M., Lively, F. O., Dawson, S., Gordon, A. W. & Morrison, S. J. (2017). The effects of breed, month of parturition and sex of progeny on beef cow fertility using calving interval as a measure. *Advances in Animal Biosciences*, *8*(s1), 67 - 71.

Twomey, A. J. & Cromie, A. R. (2023). Impact of age at first calving on performance traits in Irish beef herds. *Journal of Animal Science*, *101*, 1 - 7.

Vertsé-Zándoki, R., Kosztolányi-Szentléleki, A. & Tőzsér, J. (2021). Extracts from the Hungarian and international scientific results in Limousin cattle. *Szent István University*, *17*(1), 51 - 60.

Washaya, S., Mudzengi, C. P., Gobvu, V., Mafigu, T. & Mutore, R. (2025). Postpartum Anoestrus in Extensively Managed Beef Cows. *Theriogenology: Recent Advances in the Field*, 89.

Yavas, Y. W. J. S. & Walton, J. S. (2000). Postpartum acyclicity in suckled beef cows: a review. *Theriogenology*, *54*(1), 25 - 55.

Received: **May 30, 2025**; *Approved*: **July 15, 2025;** *Published:* **August 2025**