Zardo, L., Leseur, A., Pinzon, L., Lopes, L., Ruiz, K., Ramos, L., Galindo, B. (2026) Influence of sire EPD's and genetic rankings on weaning performance of beef calves, *Proceedings 13th World Congress on Genetics Applied to Livestock Production* 23976: https://doi.org/10.31274/wcgalp.23976 ©2026 Zardo, et al. CC BY-NC-ND

Influence of sire EPD's and genetic rankings on weaning performance of beef calves

L.G. Zardo[1], A. Leseur[2], L.M. Pinzon[3], L.S. Lopes[4], K.M. Ruiz[5], L.O. Ramos[6], and B.A. Galindo[7].

[1]Academics of Federal University of Parana, Palotina, Brazil [2]Professor of Federal University of Parana, Palotina, Brazil; [3]State University of Northern Parana, Cornelio Procopio, Brazil; Corresponding Author: luisagotardozardo@gmail.com

Introduction

Beef cattle production in Brazil reached a record high in 2024, according to the IBGE (Brazilian Institute of Geography and Statistics), approaching 238 million head. Concurrently, the adoption of Fixed-Time Artificial Insemination (FTAI) has increased, aiming for operational efficiency during the breeding season and optimized reproductive outcomes. However, to ensure higher pregnancy rates, the use of cleanup bulls following FTAI protocols has become a widely disseminated practice.

Selecting the superior sires for both FTAI and Clean up can represent the threshold between genetic stagnation and advancement within the herd. Such selection parameters involve animal phenotypes—including body structure, hoof integrity, soundness of feet and legs, and coat characteristics—as well as genetic parameters. These include Expected Progeny Differences (EPDs) and accuracy, genetic parameters (heritability, repeatability, and genetic correlations), and ranked percentiles (TOP). Essentially, producers must seek traits aligned with their specific breeding objectives. According to EMBRAPA (2019), "a sire influences both the genetic improvement and the reproductive indices of the herd"; consequently, the selection of the breeding animal must be strategically planned.

According to the ABCZ (2022), "a significant portion of females are being bred by common cattle, lacking genetic merit and breed purity." This phenomenon leads to a slow evolution in the genetic quality of the herd. The alternative to enhancing this quality is the use of genetically evaluated "improver" sires. This results in progeny with superior performance and standardized breed characteristics. Considering that the bottleneck lies in sire selection and performance evaluation—identifying the best sires for the next generation—this study aims to evaluate the weaning performance of calves as a function of the EPDs and percentiles (TOP) of the bulls selected for use as cleanup sires.

Materials & Methods

The data collected for this study originated from a family-managed livestock operation located in Paranhos, Mato Grosso do Sul, Brazil. The calves (progeny of the selected sires) were born during the 2023 and 2024 calving seasons. Sires were selected based on phenotypic criteria coupled with genetic evaluation data from two breeding programs: ANCP (National Association of Breeders and Researchers) and GENEPLUS. The dams were randomly mated to the selected sires, synchronized, and inseminated during the breeding season via FTAI from September to December. Subsequently, Nelore cleanup bulls remained with the Nelore dams for a 70-day natural service period.

Calving was concentrated between August and November. The dams were maintained in a pasture-based system with ad libitum access to mineral salt and pre-partum protein/mineral supplementation. The diet for the progeny (calves) consisted of forage and maternal milk. During periods of forage scarcity (winter), the diet was supplemented with silage and hay. Rotational grazing was implemented every week, observing the appropriate forage rest periods. Calves were weighed at birth and at weaning, at approximately 7 months of age. For this study,

weaning weights were adjusted to 210 days of age, based on the average daily gain (ADG) from birth to weaning.
Data were analyzed using Analysis of Variance (ANOVA) via the Least Squares methodology and Tukey's Honestly Significant Difference (HSD) test, using the SAS 9.4 statistical software.
A total of 482 progeny, generated from a breeding design involving 20 sires and 410 matrices over two consecutive breeding seasons, were evaluated.
In the Analysis of Variance, a significant effect was observed for the interaction between year and sire; consequently, partitioning was required for each analysis.
The statistical model considered calf weaning performance (kg) as a function of the sire selection parameters (EPDs or percentiles). Weaning year (2024 and 2025) and calf sex were included as fixed effects, and the interaction between sex and year was evaluated. In cases of significant interaction, the effects were unfolded based on the specific fixed effect.

Results

The results are detailed in the following tables, organized according to the EPDs and percentiles (TOP) of the sires selected for Cleanup bulls. The evaluated parameters include the average daily gain (in grams) of the progeny, categorized by sex (F = females and M = males) for each sire across the respective birth years.

Table 1: Pre-weaning Average Daily Gain (adjusted to 210 days) of calves sired by bulls selected based on Weaning Weight EPDs (*Acc%*) and percentiles (TOP) from the ANCP evaluation.

Year of 2023			Year of 2024			Year of 2023			Year of 2024		
EPD(*Acc%*)	**ADG F**	**ADG M**	**EPD(*Acc%*)**	**ADG F**	**ADG M**	**TOP**	**ADG F**	**ADG M**	**TOP**	**ADG F**	**ADG M**
14.68(66)	911.93 A	866.82 A	**21.84(48)**	877.98 A	946.91 A	**4**	852.17 A	819.84 A	**0.5**	877.98 A	899.25 A
21.84(48)	790.96 AB	783.28 ABC	**15.85(45)**	877.94 A	944.64 A	**0.5**	790.96 AB	783.28 A	**3**	877.94 A	946.91 A
10.87(37)	790.39 AB	828.91 AB	**14.94(61)**	864.44 A	897.01 A	**11**	790.39 AB	828.91 A	**9**	862.55 A	932.47 A
13.34(56)	780.83 AB	825.56 AB	**11.39(73)**	862.55 A	969.48 A	**6**	780.83 AB	825.56 A	**39**	830.55 AB	945.79 A
14.85(63)	712.72 BC	685.58 BC	**4.62(45)**	830.55 AB	945.79 A	**39**	699.11 ABC	773.91 AB	**1**	810.84 AB	915.19 A
4.62(45)	699.11 BC	773.91 ABC	**14.85(63)**	806.73 AB	899.25 A	**5**	643.15 BC	672.85 AB	**4**	806.73 AB	899.25 A
13.85(80)	643.15 BC	672.85 BC	**10.87(58)**	785.22 AB	932.47 A	**20**	628.11 BC	705.36 AB	**11**	785.22 AB	932.47 A
8.05(59)	628.11 BC	705.36 ABC	**18.88(67)**	780.22 AB	925.10 A	**68**	617.56 BC	675.07 AB	**6**	760.24 AB	951.85 A
0.87(62)	617.56 BC	675.07 BC	**13.34(56)**	760.24 AB	951.85 A	**10**	573.77 C	606.55 C	**24**	730.48 B	916.73 A
11(55)	573.77 C	606.55 C	**7.04(32)**	730.48 B	916.73 A						

Note: EPDs = Expected Progeny Differences (kg); TOP = Percentile ranking (%); ADG = Average Daily Gain(g); F = Females; M = Males; Acc=Accuracy. Different letters in the column indicate statistically significant differences between estimates.

Table 2: Pre-weaning Average Daily Gain (adjusted to 210 days) of calves sired by bulls selected based on Weaning Weight EPDs(*Acc%*) and percentiles (TOP) from the GENEPLUS evaluation.

Year of 2023			Year of 2024			Year of 2023			Year of 2024		
EPD(*Acc%*)	**ADG F**	**ADG M**	**EPD(*Acc%*)**	**ADG F**	**ADG M**	**TOP**	**ADG F**	**ADG M**	**TOP**	**ADG F**	**ADG M**
10.58(69)	790.39 A	828.91 A	**10.49(45)**	877.94 A	944.64 A	**3**	790.39 A	828.91 A	**0.5**	864.44 A	897.01 A
13.92(33)	643.15 B	672.85 B	**13.51(45)**	864.44 A	897.01 A	**0.5**	612.62 B	637.02 B	**2**	862.55 A	969.48 A
14.7(28)	573.77 B	606.55 B	**11.59(58)**	862.55 A	969.48 A				**3**	824.83 AB	938.05 A
			10.58(33)	782.34 AB	932.47 A				**0.1**	780.22 AB	925.10 A
			17.33(61)	780.22 AB	925.10 A				**12**	730.48 B	916.73 A
			7.56(41)	730.48 B	916.73 A						

Note: EPDs = Expected Progeny Differences (kg); TOP = Percentile ranking (%); ADG = Average Daily Gain(g); F = Females; M = Males; Acc=Accuracy. Different letters in the column indicate statistically significant differences between estimates.

Table 3: Pre-weaning Average Daily Gain of calves sired by bulls selected based on Birth Weight EPDs(*Acc%*) and percentiles (TOP) from the ANCP evaluation.

Year of 2023			Year of 2024			Year of 2023			Year of 2024		
EPD(*Acc%*)	ADG F	ADG M	EPD(*Acc%*)	ADG F	ADG M	TOP	ADG F	ADG M	TOP	ADG F	ADG M
1,52(69)	911,93 A	866,82 A	**1,92(61)**	877,98 A	946,91 A	**98**	790,96 A	783,28 AB	**98**	877,98 A	946,91 A
1,92(61)	790,96 AB	783,28 ABC	**0,87(68)**	877,94 A	944,64 A	**17**	790,39 A	828,91 A	**75**	877,94 A	944,64 A
-0,06(59)	790,39 AB	828,91 AB	**2,38(66)**	864,44 AB	897,01 A	**79**	780,83 A	825,56 AB	**59**	862,55 A	969,48 A
0,95(44)	780,83 AB	825,56 ABC	**0,61(41)**	862,55 AB	969,48 A	**94**	777,54 AB	777,70 AB	**0,1**	830,55 AB	945,79 A
1,31(69)	712,72 ABC	685,58 ABCD	**-0,2(38)**	830,55 AB	945,79 A	**91**	712,72 AB	685,58 AB	**100**	810,84 AB	915,19 A
-0,2(38)	699,11 BC	773,91 ABC	**1,31(22)**	806,73 AB	899,25 A	**0,1**	699,11 AB	773,91 AB	**91**	806,73 AB	899,25 A
1,5(22)	643,15 BC	672,85 CD	**-0,06(59)**	785,22 AB	932,47 A	**34**	628,11 AB	705,36 AB	**17**	785,22 AB	932,47 A
0,24(30)	628,11 BC	705,36 ABCD	**2,33(56)**	780,22 AB	925,10 A	**3**	617,56 AB	675,07 AB	**79**	760,24 AB	951,85 A
-0,78(41)	617,56 BC	675,07 BCD	**0,95(344)**	760,24 AB	951,85 A	**76**	573,77 B	606,55 B	**30**	730,48 B	916,73 A
0,89(58)	573,77 C	606,55 D	**0,17(40)**	730,48 B	916,73 A						

Note: EPDs = Expected Progeny Differences (kg); TOP = Percentile ranking (%); ADG = Average Daily Gain(g); F = Females; M = Males; Acc=Accuracy. Different letters in the column indicate statistically significant differences between estimates.

Table 4: Pre-weaning Average Daily Gain of calves sired by bulls selected based on Birth Weight EPDs(*Acc%*) and percentiles (TOP) from the GENEPLUS evaluation.

Year of 2023			Year of 2024			Year of 2023			Year of 2024		
EPD (*Acc%*)	ADG F	ADG M	EPD(*Acc%*)	ADG F	ADG M	TOP	ADG F	ADG M	TOP	ADG F	ADG M
0,27 (65)	790,39 A	828,91 A	**0,43(31)**	877,94 A	944,64 A	**65**	790,39 A	828,91 A	**80**	877,94 A	944,64 A
0,87(41)	643,15 B	672,85 B	**1,77(43)**	864,44 AB	897,01 A	**99**	643,15 B	672,85 B	**74**	862,55 A	969,48 A
0,63(41)	573,77 B	606,55 B	**0,36(22)**	862,55 AB	969,48 A	**93**	573,77 B	606,55 B	**99**	810,84 AB	915,19 A
			0,27(65)	785,22 BC	932,47 A				**65**	785,22 AB	932,47 A
			1,07(38)	780,22 BC	925,10 A				**38**	730,48 B	916,73 A
			0,04(30)	730,48 C	916,73 A						

Note: EPDs = Expected Progeny Differences (kg); TOP = Percentile ranking (%); ADG = Average Daily Gain(g); F = Females; M = Males; Acc=Accuracy. Different letters in the column indicate statistically significant differences between estimates.

Table 5: Pre-weaning Average Daily Gain of calves sired by bulls selected based on Average Daily Gain (ADG) EPDs(*Acc%*) and percentiles (TOP) from the GENEPLUS evaluation.

Year of 2023			Year of 2024		
EPD(*Acc%*) / TOP	ADG F	ADG M	EPD (*Acc%*)/ TOP	ADG F	ADG M
13,34 (44)/ 1	790,39 A	828,01 A	**15,01(54) / 0,5**	877,94 A	944,64 A
7,41(52) / 13	643,15 B	672,85 B	**16,94 (66)/ 0,1**	864,44 A	897,01 A
14,32 (38)/ 0,5	573,77 B	606,55 B	**11,77(48) / 2**	812,44 AB	951,40 A
			13,34(44) / 1	782,34 AB	932,47 A
			11,44(32) / 3	730,48 B	916,73 A

Note: EPDs = Expected Progeny Differences (kg); TOP = Percentile ranking (%); ADG = Average Daily Gain(g); F = Females; M = Males; Acc=Accuracy. Different letters in the column indicate statistically significant differences between estimates.

Discussion

Based on the results, a consistent pattern was observed in calf performance relative to the EPDs and percentiles (TOP) of their sires (Tables 1 to 5). It was noted that proximal EPD values do not necessarily guarantee superior or inferior performance, as accuracy serves as an indicator of the precision of the EPD estimates; however, as the divergence between EPD values increases, the likelihood of obtaining statistically significant differences in progeny

performance also increases. It is important to emphasize that sires with similar EPDs may yield diverse performance outcomes, which may or may not reach statistical significance. This trend remained consistent for percentile rankings (TOP) across all evaluated traits.

Individual analysis revealed that for males born in 2024, no significant differences were found regarding either TOP or EPDs; thus, there was no significant effect derived from the genetic parameters used for sire selection. In this instance, it is suggested that environmental factors exerted a greater influence on average daily gain (ADG) than genetic factors. Specifically, the year 2024 experienced higher rainfall—resulting in superior pasture quality—whereas 2023 was characterized by greater climatic instability (sporadic drought), leading to higher weight variation.

In contrast, a significant effect was observed for the same sex animals in 2023 and for females in 2024, demonstrating that sires selected based on superior EPD and TOP parameters achieved better results as their genetic indices improved.

Regarding EPDs for growth traits, animals with higher values are generally expected to be the preferred sires. However, this study found that animals with superior genetic numbers did not always rank highest in ADG, which may suggest the presence of a Genotype x Environment (G×E) interaction. For results based on percentile ranking (TOP), it was observed that as the sire's ranking improved, the weight gain performance of the progeny also increased. This outcome was expected, as genetic evaluations account for contemporary groups, pedigree information, and various environmental effects.

Conclusions

Based on the results, it is concluded that years characterized by greater climatic instability cause animals with different genetic potentials to progress divergently (due to higher environmental influence). This explains the significant effects observed for both sexes in 2023 and for females in 2024. Conversely, when the environment is favorable and minimizes nutritional or climatic stress, the impact of genetic differences between genotypes tends to diminish or may even be nullified.

Other factors to be considered are the effects of sex and birth year, which exert a strong influence particularly when the environment presents greater challenges. Furthermore, animals with higher EPD values and intermediate percentile rankings (TOP) do not necessarily produce progeny with the highest Average Daily Gain (ADG) values, reinforcing the complexity of phenotypic expression in beef cattle production systems.

Acknowledgements

The authors would like to express their gratitude to Fazenda Rincão das Laranjeiras for providing the database for this study. Special thanks are also extended to GENEPLUS and ANCP for providing the overall genetic evaluation results for the sires evaluated in this research.

References

Instituto Brasileiro de Geografia e Estatística. "Produção Agropecuária". Share.google, www.share.google/XM8VMoJ9fD40v78N0. Access in January 30th, 2026.

Estadão Conteúdo. "Déficit Anual de Touros de Reposição Supera 300 Mil Cabeças No Brasil." Canal Rural, 29 Apr. 2022, www.canalrural.com.br/programas/canal-do-criador/deficit-anual-de-touros-de-reposicao-supera-300-mil-cabecas-no-brasil/. Access in January 30th, 2026.

"Seleção de Touro Reprodutor Influencia No Melhoramento Genético Do Rebanho." www.embrapa.br, www.embrapa.br/busca-de-noticias/-/noticia/44242415/selecao-de-touro-reprodutor-influencia-no-melhoramento-genetico-do-rebanho. Access in January 30th, 2026.