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PERFIL DO SISTEMA DE PRODUÇÃO DE GADO CURRALEIRO PÉ DURO NO ESTADO DO TOCANTINS, BRASIL

PROFILE OF THE CURRALEIRO PÉ DURO CATTLE PRODUCTION SYSTEM IN THE STATE OF TOCANTINS, BRAZIL

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RESUMO

Historicamente, o desenvolvimento da pecuária na região amazônica se deu em meados de século 17, com bovinos de raças ibéricas, que se expandiram por diversas regiões da Amazônia legal. A ação do meio associado ao sistema de produção facilitou o desenvolvimento de raças regionalmente adaptadas, como o Curraleiro Pé Duro (CPD). Foi analisado o perfil do sistema de produção de bovinos CPD criados no Tocantins, em que se entrevistou 13 criadores, no periodo de agosto de 2020 a fevereiro de 2021, distribuídos em 11 municipios no Estado, através da aplicação de um questionário semi-estruturado, contendo questões a respeito do perfil do produtor, objetivo-fim da criação, tamanho do rebanho, contendo ainda, informações de origem ou procedência dos animais, número de animais, e aspectos ligados ao manejo geral dos rebanhos. Existe uma variação no efetivo de animais por produtor, e no objeto da criação que variaram de resgate da raça, consumo próprio, questões familiares e cultura regional. A maioria dos produtores se classifica como pequeno e médio produtor (41,67%) não tendo a atividade como principal fonte de renda, contra 33,34% que detem a atividade como principal atividade econômica. E 25% tem a criação de CPD apenas como um resgate cultural-regional ou para fins de consumo próprio, caracterizando-se como pequeno produtor. Na maioria das propriedades (83,34%) observou-se áreas de cultivo de pastagens, em sistema extensivo com oferta desse material e suplementação mineral e proteico-energética. Os sistemas de produção de CPD no Tocantins caminham para uma profissionalização, com objetivos de oferta de produtos diferenciados no mercado local.

Palavras-chave: Bioma cerrado. Bovinos. Criador. Gado adaptado aos Trópicos. *Bos Taurus*.

ABSTRACT

The livestock development in Brazil took place in the mid-17th century, with the introduction of Iberian cattle breeds, which expanded across several regions of the Legal Amazon. The action of the environment, associated with the production system, facilitated the development of adapted breeds such as the Curraleiro Pé Duro (CPD). The knowledge and organization of this chain are important to define strategies for the evolution and social and economic development of the sector in the region. In this study, we analyzed the profile of the production system for CPD cattle raised in Tocantins by interviewing 13 breeders the state using a semi-structured questionnaire. According to the responses, the herd size included conservation, own consumption, family questions, regional culture, or formation of the breed dairy and/or organic beef, and/or premium quality beef. Additionally, 25% raise CPD only as a cultural-regional conservation practice or for their own consumption purposes. Most farms (83.34%) had areas of pasture cultivation in an extensive system where this material was supplied along with mineral and protein-energy supplement. In general, the breeding system demonstrating acceptance of technological practices in aiming at greater productivity, and moving towards professionalization, with the objective of offering differentiated products in the local market

Keywords: Breeder. Cattle. Cattle adapted to the Tropics. Cerrado biome. *Bos Taurus*.

INTRODUCTION

The livestock sector has had a notable contribution to the economy of the state of Tocantins, Brazil, as well as of the entire country. Each year, Brazilian livestock has occupied increasingly prominent positions in the world scenario, especially in the meat trade. In 2019, Brazil's gross domestic product (GDP) was BRL 7.3 trillion, a nominal increase of 6.8% relative to the previous year. Part of this growth was due to the livestock GDP, which rose slightly in the same period, going from 8.3 to 8.5% of the total GDP, demonstrating the strength of the sector in the Brazilian economy (ABIEC, 2021).

According to projections for the agribusiness market (MAPA, 2020), from 2019/20 to 2029/30, beef production is expected to grow by 1.4% per year, with a final increase of 23.8%. With increasingly tight profit margins, rural producers have focused efforts on the professional management of their activities by attempting to maintain a positive relationship between revenue and costs, aiming at increased productivity, with the use of appropriate technologies, since Brazil has held a steady leadership in exports. Likewise, grain production has significantly grown in recent years, especially with the opening and expansion of the MATOPIBA (Maranhão, Tocantins, Piauí, and Bahia) agricultural frontier (FIETO, 2018).

Brazilian agribusiness—livestock in particular—is one of the main elements that have boosted the country's economy. However, it is also the core of a polarized debate on animal welfare, the impact of consumption of animal products on human health, and the environmental sphere, where it is related to the production of greenhouse gases (DICK ET AL., 2021; DUMONT ET AL., 2019).

In contrast to these controversies, animal production in different regions of the world contributes significantly to subsistence, poverty reduction, and gender equality (ADESOGAN ET AL., 2020). In today's world, environmental, economic, and social forces have caused important changes in the concepts of livestock production, and consumers have driven changes in production systems and in the market by demanding respect for biodiversity and the environment and requesting alternative sources of trade, such as products with an environmental, organic, and geographical indication seal.

The continental dimension of Brazil, its variety of ecosystems, and the socioeconomic diversity of its regions and of the universe of producers provide the Brazilian beef cattle industry with a considerable range of production systems, thus hindering equitable development in the different regions.

Likewise, the market has prioritized sustainable livestock farming, with genetic diversity and preservation of naturally adapted animals. This polarization has caused breeds that were under strong threat of extinction to grow and gain prominence in the national scene. In this respect, the state of Tocantins has shown a significant number

of producers of the Curraleiro Pé Duro (CPD) breed, who have joined efforts to make the breed and its products a differentiated alternative.

Curraleiro Pé Duro cattle are found in the *cerrado* and semi-arid biomes. These animals are characterized by their hardiness, ability to adapt to adverse environmental conditions, and low production cost. They are mostly used for beef production due to their good carcass yield as well as the tenderness and distinguished flavor of their meat. Some producers and researchers have exhibited an interest in the conservation of the CPD breed, aiming at production itself and the valuation of the potential of this genetic and cultural heritage of Brazil (FIORAVANTI ET AL. 2011; SALLES ET AL., 2011; FÉLIX ET AL., 2013).

When it comes to CPD cattle, it is believed that the breed only serves as genetic material for crossbreeding. Research has shown that the breed produces differentiated meat and milk, with the former having great tenderness and the latter a high fat content, which can result in greater added value to the product. In addition, there is a demanding market that seeks products with differentiated quality as well as certified organoleptic value and softness. Producers in Tocantins are committed to promoting the genetic improvement of the breed and creating a strategy that allows placing milk and meat from this genetic material on the market, with a seal of controlled origin or geographical indication.

Given the above observations, a proper characterization of the CPD production systems in Tocantins is necessary to guide public policies aimed at the development and strengthening of the sector. Therefore, we developed the present study to identify the profile of production systems for the CPD breed in the state of Tocantins, Brazil.

MATERIAL AND METHODS

This experiment was conducted from August 2020 to February 2021. Twelve Curraleiro Pé Duro (CPD) herds raised in the state of Tocantins, Brazil, were selected. The herds are geographically distributed across the municipalities of Araguaína, Babaçulândia, São Bento do Tocantins, Palmas, Monte Santo do Tocantins, Divinópolis do Tocantins, Rio Sono, Pedro Afonso, Lizarda, and Mateiros (Figure 1).

The producers that would take part in this study were chosen based on

information provided by the Brazilian Association of Curraleiro Pé Duro Breeders (ABCCPD), located in the state of Piauí. From the contacts received, we obtained information about a group in an instant messaging application where we met other CPD breeders in Tocantins. Of these, 13 breeders were willing to take part in the study.

To outline the profile of CPD breeders, we applied a semi-structured questionnaire with questions about the producer's profile, characterizing them by profession, purpose of farming, educational level, and herd composition and size; information on the origin of the animals, number of animals, farm area, roughage production, and animal feeding; and aspects related to the general management of the herds, such as vaccination, data control, reproduction systems, and use of reproductive biotechnologies.

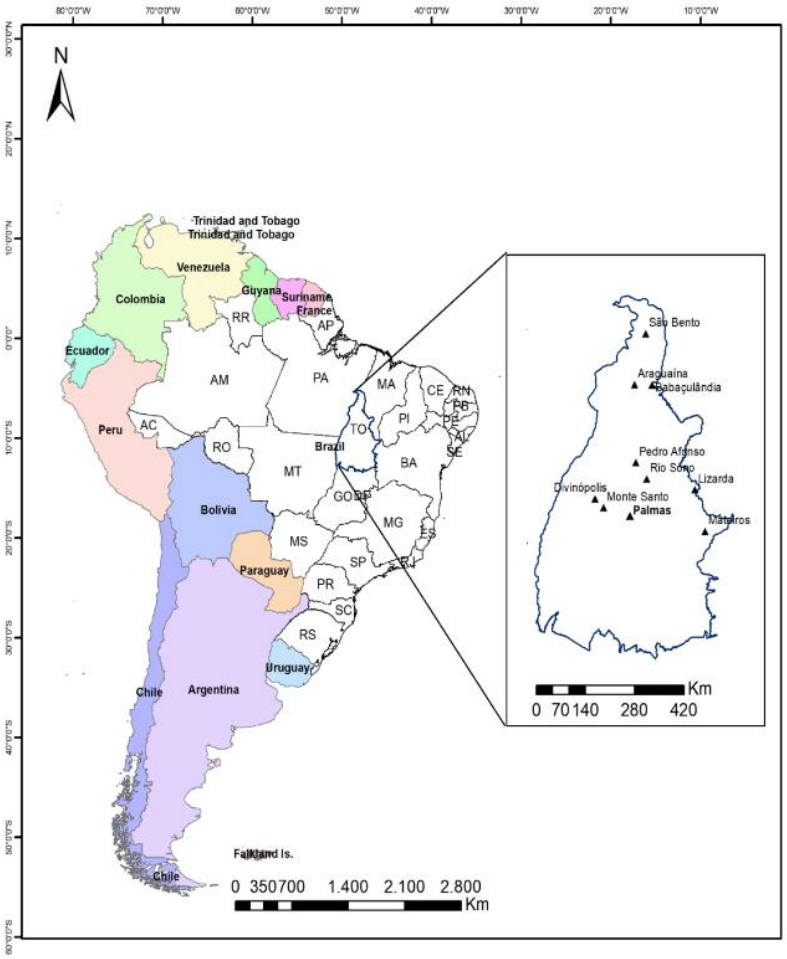

Figure 1. Geographical distribution of Curraleiro Pé Duro herd farms that constituted the sample space in the state of Tocantins.

Data were collected and organized in a database using electronic spreadsheets, which was followed by descriptive analysis

RESULTS

Table 1 describes the analyzed farms, which are distributed across 11 municipalities in Tocantins, representing the CPD cattle population in the state. There is no census for this breed in the state; however, these are characterized as the main breeders in Tocantins, thus representing the breed's herd.

As can be seen, there is a varied number of animals per producer, which, to a certain extent, characterizes the purpose of raising the animals of each farmer. According to the responses to the questionnaire, the decision to maintain the farm and herd size varied, including conservation of the breed, own consumption, family questions, regional culture, or even the improvement of the breed for a dairy and/or organic beef and/or premium quality beef herd.

Table 01. Sample herd, size, and geographical distribution of the Curraleiro Pé Duro herd in the state of Tocantins.

Farm	Area (ha)	N of animals	Municipality of TO
01	150	87	Palmeirante
02	300	80	Lizarda
03	800	55	Mateiros
04	82	125	Divinópolis
05	387.2	30	Rio Sono
06	10	18	Palmas
07	178	16	Monte Santo do Tocantins
08	3.000	37	Rio Sono
09	242	37	São Bento do Tocantins
10	250	20	Babaçulândia
11	418	07	Babaçulândia
12	150	65	Araguaína
13	300	12	Pedro Afonso
TOTAL	5,817.20	587	-

The varying farm sizes indicate a fluctuation in the profile of producers, since CPD is not the only breed in the production system and livestock is not the predominant activity carried out on the farm. This dispersion also allows us to relate the nature of the agricultural venture, as 41.67% of the producers classify themselves

as small and medium, for whom livestock is not the main line of business, whereas only 33.34% of respondents declared agribusiness is their main economic activity. The remaining 25% raise CPD cattle only as a cultural-regional conservation practice or for their own consumption, which characterizes them as small producers.

Most farms (83.34%) have areas of pasture cultivation, with a predominance of grasses adapted to the *cerrado* biome (*Brachiaria*, *Panicum*, and *Andropogon*), besides an environmental preservation area and native forest for grazing by CPD cattle. Only two (02) owners reported that they do not have a native pasture area, as they dedicate a larger area to growing crops (soybean).

The farms are located in municipalities spread across five microregions of Tocantins (Bico do Papagaio, Araguaína, Miracema do Tocantins, Porto Nacional, and Jalapão). It is worth mentioning that these microregions differ in soil and climate conditions, as well as in social-economic development. According to the Köppen classification system, the climate of the municipalities is classified as a humid tropical type, with annual precipitation ranging from 1,400 to 2,000 mm. The soils in the municipalities of these microregions are generally classified as Neosols, although the microregion of Miracema do Tocantins and the capital, Palmas, have a predominance of Plinthosols (LIMA; OLIVEIRA: AQUINO, 2000; IBGE, 2007).

The microregions of Jalapão (municipalities of Rio Sono, Lizarda, and Mateiros) and Miracema do Tocantins (Divinópolis and Monte Santo do Tocantins) are among the largest soybean producers in the state, along with the municipalities of Pedro Afonso and Palmeirante (microregion of Porto Nacional and Araguaína).

However, the microregions of Bico do Papagaio and Jalapão, where municipalities with the worst socioeconomic indicators in Tocantins were concentrated, accumulate a historical economic-social deficit. The Bico do Papagaio region and some municipalities in the Jalapão region (Mateiro and Lizarda) are still characterized by livestock farming and low use of technology in agriculture. Both municipalities struggle with the low volume of rainfall, which has caused problems for some crops (soybean, maize, and cotton) as well as the development of livestock. Furthermore, considering the GDP, the microregions of Miracema do Tocantins and Bico do Papagaio lost relative importance within the state from 2002 to 2010 (GUEDES

& BRITO, 2014; OLIVEIRA & STRASSBURG, 2014).

On all farms, the animals are raised on pasture and supplemented with minerals and vitamins. About 32% of the owners offer protein-energy supplementation, mainly in the dry season. Cultivated pastures consist mostly of species of the genera *Panicum*, *Brachiaria*, and *Andropogon*.

On 58.34% of the farms, the animals use water from waterholes, streams, and ponds, whereas 41.66% use a water distribution system that supplies the water to drinkers. However, only three farms use water from an artesian well, i.e., these supposedly had water of superior quality. Because information was collected through a questionnaire distributed to a group of producers via a messaging application, it was not possible to ascertain the water quality or the conditions of access to the water supply system for the others. This warrants further information and even investigations that can contribute to the characterization of the water on these farms, determining whether the resource and its quality are suitable for animal consumption; whether the source/site of supply requires improvement or changing; or whether it could be compromising animal performance. These observations are of great value, since they can compromise the health and/or production/breeding of the animals. It is noteworthy that, coupled with nutritional, environmental (welfare), as well as other management characteristics, these factors can compromise the production system.

According to the producers, in forming the herds, they acquired animals from herds from the very state, with the majority being from the Jalapão region. The herd was also constituted by animals from other locations as well as the states of Maranhão, Goiás, and Pará. It is worth noting that 87.38% of farmers composed their herd using animals from the state of Goiás. Although the state of Tocantins was formed by the division of the northern region of the state of Goiás, most of the farms (92%) are relatively new and belong to producers with an average age of 48.34±2.3 years, 58.34% of whom have been in the activity for approximately 10 years.

It was not possible to present accurate data regarding the genetic composition of the herd, as the answers were not clear and well defined. However, as previously stated, the acquisition of animals was based on local and traditional knowledge, although some producers acquired animals from herds accredited by the Brazilian

Association of CPD Breeders, in the state of Goiás.

On all farms (100%), the animals are vaccinated with at least the control vaccines determined by the Animal Health Defense agency, e.g., brucellosis, rabies, and foot-and-mouth disease. In 91.67% of the herds, there is no control of mounting, which is performed naturally, and only one farm reported using artificial insemination (AI) and breeding season. As for the use of reproductive biotechnologies (AI), the respondents informed that the semen used came from the Insemination Center as well as from a consortium of producers involving the acquisition of material from farms with a higher technological level from another state (there was no interest in mentioning which). Birth control is performed in 41.67% of the herds, but 100% of the farms lack control of reproduction and production data, that is, producers do not carry out measurements, weighing, or reproductive or genealogical control of the herd.

When the participants were asked about the purpose of the raising CPD, answers varied substantially, with 25% stating the objective is to conserve the breed, 41.67% declaring that they raise the animals for their own consumption and cultural/regional values, 16.67% stating they produce meat with geographical identification or a certification, and 16.67% having a dairy herd.

DISCUSSION

The state of Tocantins has a large territory, which provides great climatic, soil, and ecological diversity. Thus, knowledge of the particularities of each municipality is essential for production practices to be aligned with the objectives of sustainable production.

Pasture-based animal production is recognized as an advantageous approach in the search for a more sustainable agribusiness (CHANG ET AL., 2015), besides having great potential for improving productivity through lower costs and low-impact practices (VALE ET AL., 2019). The municipalities of Tocantins where CPD cattle are raised are characterized by an economy based mainly on agriculture and the service sector, with typical *cerrado* vegetation, a humid tropical climate, average rainfall of 1,760 mm, and average temperature of 27.83 ºC. In terms of the evolution of the cattle herd, the municipalities of Araguaína and Babaçulândia stand out, whereas the

municipalities of Palmeirante, Rio Sono, São Bento, and Pedro Afonso are highlighted for grain production.

With the expansion of agricultural frontiers in the last decade, especially for soybean production, the state became a center of attraction for investments (Rodrigues and Rodrigues, 2008), which caused livestock to lose ground and production systems to become more technological. Some municipalities in the microregions of Jalapão, Dianópolis, and Miracema do Tocantins are amongst the largest soybean producers in the state, and the data show that these microregions were those where the GDP per capita grew the most. However, the microregions of Bico do Papagaio and Jalapão are still in need of better infrastructure.

Fioravanti et al., (2011) identified about 10 CPD farms in the state of Tocantins. These are located mainly in the microregions of Gurupi, Porto Nacional, and Jalapão, in the southern and southernmost regions of the state, with greater proximity to the border with the state of Goiás. These researchers evaluated 1,368 animals, whereas the present study analyzed 587 cattle from 12 farms distributed across five microregions of Tocantins (Bico do Papagaio, Araguaína, Miracema do Tocantins, Porto Nacional, and Jalapão), covering the northern, northernmost, southern, and southernmost regions of the state.

This difference may be explained by the methodology applied in each scientific investigation, since, in the present study, we obtained the information from ABCPD references, which mentioned the sample population of breeders in an official messaging application group. In the abovementioned study of Fioravanti et al., (2011), the methodology involved telephone contacts, correspondence, and exploratory visits, as part of a project of the Veterinary School at the Federal University of Goiás. Moreover, at the time of the study, the breeders' association (ABCPD) had not yet been consolidated and some technological and electronic facilities were not so easily accessible (e.g., electronic message groups and electronic communication profiles).

However, both studies involved the application of a semi-structured questionnaire. In the present case, a "googleforms" electronic file was sent to the producers who were willing to fully answer the questionnaire. This may, to some degree, add to the explanation of the difference in the sample (farms and number of

animals) between studies.

Barbosa (2012) evaluated the profile of the producer and the production system of CPD herds in the semi-arid region of Brazil and also observed differences in comparison with the data presented by Fioravanti et al., (2011), which are possibly due to the sample size and the greater number of federative units sampled.

Regarding the management system, almost all herds (91.67%) are raised in a semi-extensive manner, which is in disagreement with Fioravanti et al., (2011) and Barbosa (2012). This information is important, as we found that the farms adopt a medium technological level, considering that producers carry out another agricultural activity, such as raising beef or milk animals or growing grain crops (soybean). In addition, they also affirmed to make use of supplementation and vaccinate the animals, and 25% stated they have some type of technical assistance.

In a study with 28 herds in which questionnaires were also applied, Fioravanti et al., (2011) described that 15 respondents (53.6%) adopted a medium technological level and 13 (46.4%) a low technological level. The authors reported that the farms solely use the extensive system, with exclusive grazing of natural vegetation, little or no technical assistance, feed supplementation, and animal identification. According to the researchers, this is explained by the data provided by the agricultural census, which revealed that the state of Tocantins holds 34.6% of the area of farms with natural pasture. In the Jalapão region (east of the state), this percentage is higher, reaching 55%. However, although the present study also reveals the use of grazing in natural fields, 100% of the farms had areas where pasture was used specifically for animal feed.

In the herds analyzed in the study of Fioravanti et al., (2011), in the state of Goiás, there is no mineral supplementation for the cattle. Nonetheless, in the state of Tocantins, almost all farms provide mineral and protein-energy supplementation almost all year round. This statement is a contradiction, as the authors initially affirmed that the predominant farming system was exclusively extensive, with exclusive grazing in a native pasture area. According to the data obtained in the present study, the CPD cattle on the 12 evaluated farms graze in areas with cultivated grass, which may or may not be associated with grazing in areas of native grass and native

pasture. Mineral supplementation is provided throughout the year and, on some farms, protein-energy supplementation is given in certain periods (dry season) of the year.

It is thus clear that despite not having an essentially economic or productive character, since purposes differ between producers, CPD cattle farming in Tocantins is regarded by all respondents as a professional activity, rather than a family venture, and also not a silvopastoral system. This difference can be explained by the temporal effect between studies. In the last decade, Tocantins has increasingly invested in efficiency and competitiveness in sectors with strong growth potential, especially agribusiness. Agribusiness in Tocantins is moving towards sustainability, focused on improving productivity through systematic technological innovation and the social inclusion of rural communities, as their good performance can significantly contribute to improving income distribution and poverty reduction. Most livestock activities have grown above the Brazilian average, indicating the magnitude of agriculture in the state.

The answers suggest that some producers have joined efforts towards a more commercial exploitation in response to market changes and consumers who are demanding differentiated products with flavor, texture, tenderness, and other intrinsic and organoleptic traits that meet their expectations. Thus, most of the interviewed producers (66.67%) have endeavored to prioritize the adoption of technologies in animal management as well as selection practices (*in vivo* ultrasound evaluation of the carcass, genotyping for A2 beta-casein, use of AI and fixed-time AI, among others) that will ensure desirable characteristics and genetic gain in the herd. The greater adoption of technology is a consequence of the agricultural development model employed in the agricultural frontiers of the country. This model is marked by intensive soil management in which the production of grains and energy concentrates, integrated with animal husbandry, has been replacing the traditional extensive cattle farming systems (JESUS ET AL., 2021).

The motivation for this is to add value to the product and meet the new consumption pattern by offering a differentiated product with geographical identification or a certification seal of welfare, organic production, or even cultural/regional heritage, as a way of valuing local uses and customs. It is understood that, even for CPD, the appeal of being an indigenous, naturalized, native breed is very

great, but its use for commercial purposes lacks a basic infrastructure involving the adoption of technologies and management strategies that enable increased performance.

In Brazil, the production and sale of these naturalized breeds have been growing and gaining market share with the introduction of differentiated meat and/or milk products, in terms of intrinsic or organoleptic traits, as well as products with geographical identification (BRANDÃO ET AL., 2012; MAYSONNAVE ET AL., 2014; MORAES ET AL., 2013; VEIGA 2011). In Paraguay, Britez et al. (2019) and Servin et al., (2019) also demonstrated the importance and appreciation of products of naturalized breeds with geographical identification, although the lack of knowledge and marketing is still a factor to be overcome.

CONCLUSION

The analyzed CPD herds are distributed across five microregions in the state of Tocantins with varying numbers of head, which may in some cases be explained by the purpose of farming. In general, the farming system for the analyzed CPD herds in Tocantins is similar to that of breeds with larger herds and which are more commonly farmed in the state. This indicates acceptance of technological practices, aiming at greater productivity and the possibility of commercial exploitation for a differentiated market.

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Conflict of interest

All authors declare that there is no conflict of interest.

Ethics committee statement

This study was developed with the results of a semi-structured questionnaire applied to participants who signed a Consent Term. Therefore, there is no need for approval by the ethics committee of the Federal University of Tocantins

REFERENCES

ADESOGAN, A. T., HAVELAAR, A. H., MCKUNE, S. L., EILITTÄ, M., & DAHL, G. E. Animal source foods: Sustainability problem or malnutrition and sustainability solution? Perspective matters. **Global Food Security**, v. 25, p. 100325, 2020. DOI: https://doi.org/10.1016/j.gfs.2019.100325

ASSOCIAÇÃO BRASILEIRA DAS INDÚSTRIAS EXPORTADORAS DE CARNE (ABIEC). **Beef Report: Perfil da Pecuária no Brasil**, 60p. ABIEC, São Paulo, 2021.

BARBOSA VV. Conservação da raça Curraleiro Pé-duro no nordeste brasileiro: Características de produção e perfil do criador. 2012. Universidade Estadual da paraíba, Centro de Ciências Biológicas e da Saúde, 2012. 59f. (**Monografia**). Disponível em: http://dspace.bc.uepb.edu.br:8080/xmlui/handle/123456789/4098.

BRANDÃO FS, CEOLIN AC, CANOZZI MEA, RÉVILLION JPP, BARCELLOS JOJ. Confiança e agregação de valor em carnes com indicação geográfica. **Arq. Bras. Med. Vet. Zootec.**, v.64, n.2, p.458-464, 2012. DOI: https://doi.org/10.1590/S0102-09352012000200028

BRITEZ GDV, SERVIN AEM, DUARTE NDL, DUARTE JAV, AGUERO, MAF. Percepción de la indicación geográfica en carne bovina y disposición a pagar. **Investig. Agrar.**, v.21, n.2, p.149-156, 2019. DOI: 10.18004/investig.agrar.2019.diciembre.149-156.

CARVALHO, J.H. **Potencial econômico do bovino pé-duro**. Documentos 65. 14f. Teresina: Embrapa Meio-Norte, 2002. Disponível em: http://www.infoteca.cnptia.embrapa.br/handle/doc/65454.

CHANG, J., VIOVY, N., VUICHARD, N., CIAIS, P., CAMPIOLI, M., KLUMPP, K., MARTIN,R., LEIP, A., SOUSSANA, J. F. Modeled changes in potential grassland productivity and in

grass-fed ruminant livestock density in Europe over 1961–2010. **PLoS One**, v. 10, n. 5, p. e0127554, 2015. DOI://doi.org/10.1371/journal.pone.0127554

DICK M, SILVA MA, SILVA RRF, FERREIRA OGL, MAIA MS, LIMA SF, PAIVA NETO VB, DEWES H. Environmental impacts of Brazilian beef cattle production in the Amazon, Cerrado, Pampa, and Pantanal biomes. **Journal of Cleaner Production**, v. 311, p. 127750, 2021. DOI: https://doi.org/10.1016/j.jclepro.2021.127750

DUMONT B, RYSCHAWY J, DURU M, BENOIT M, CHATELLIER V, DELABY L, DONNARS C, DUPRAZ P, LEMAUVIEL-LAVENANT S, MÉDA B, VOLLET D, SABATIER R. Review: associations among goods, **impacts and ecosystem services provided by livestock farming. Animal**, v.13, n.8, p.1773-1784, 2019. DOI: https://doi.org/ 10.1017/S1751731118002586

FEDERAÇÃO DAS INDÚSTRIAS DO ESTADO DO TOCANTINS (FIETO). **Carne bovina: Plano estratégico para as cadeias produtivas do agronegócio no Estado do Tocantins: 2018 - 2027** / 168 p. José Roberto Fernandes, Marcos Fava Neves (Coordenadores). – Palmas, TO: Sistema FIETO, 2018.

FELIX GA, PIOVEZAN U, JULIANO RS, SILVA MC, FIORAVANTI MCS. Potencial de uso de raças bovinas locais brasileiras: Curraleiro Pé-duro e Pantaneiro. Enciclopédia Biosfera, Goiânia, v.9, n.16; p.1715-1741, 2013. Disponível em: https://www.conhecer.org.br/enciclop/2013a/agrarias/potencial%20de%20uso.pdf

FÉLIX GA, PIOVEZAN U, JULIANO RS, SILVA MC, FIORAVANTI MCS. Potencial de uso de raças bovinas locais brasileiras: Curraleiro Pé-Duro e Pantaneiro. **Enciclopédia Biosfera**, v. 9, n. 16, 2013. Disponível em: http://www.conhecer.org.br/enciclop/2013a/agrarias/potencial%20de%20uso.pdf.

FIORAVANTI MCS, JULIANO RS, COSTA GL, ABUD LJ, CARDOSO VS, CARPIO MG, C MFO. Conservación del bovino Curraleiro: cuantificación del censo y caracterización de los criadores. **Anim Genet Resour**. [online]. 2011; 48: 109-16. Disponível em: http://www.fao.org/3/a-i2200t/i2200t13.pdf

GOVERNO DO ESTADO DO TOCANTINS. **Perfil do agronegócio tocantinense** (versão final). 145p.Secretaria de Planejamento e Orçamento, Governo do Estado do Tocantins. Relatório final (Contrato nº 034/2015). 2016,

GUEDES, L. DA S., & BRITO, J. L. S. Caracterização socioeconômica da microrregião geográfica de Araguaína (TO) / Socioeconomic characterization of geographical microregion of Araguaina (TO). **OBSERVATORIUM: Revista Eletrônica de Geografia**, v.6, n.17, p. 91-103, 2014.

IBGE. INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA. ESTADO DO TOCANTINS: **Pedologia, Mapa Exploratório de Solos. Coordernação de Recursos Naturais e Estudos Ambientais**. 1ª Edição, 2007. Disponível em:

https://geoftp.ibge.gov.br/informacoes_ambientais/pedologia/mapas/unidades_da_federacao/to_pedologia.pdf

JESUS RM, SILVA MC, ZEVIANI WM, PEREIRA RM, CARDUCCI CE. Bovinocultura a pasto em Laguna Carapã-MS soba ótica da transição do uso do solo. **Organizações Rurais & Agroindustriais**, Lavras, v. 23, e1789, 2021. Disponível em: http://www.revista.dae.ufla.br/index.php/ora/article/view/1789. Acesso em: 14 jun. 2023.

LIMA, A.A.C.; OLIVEIRA, F.N.S.; AQUINO, A.R.L. de. **Solos e aptidão agrícola das terras do Estado do Tocantins. Fortaleza: Embrapa Agroindústria Tropical**, 27p. (Embrapa Agroindústria Tropical. Documentos, 31). 2000.

MAYSONNAVE GS, VAZ FN, PASCOAL LL, PACHECO PS, MELLO RO, MACHADO GK, NARDINO TAC. Percepção de qualidade da carne bovina com marca no sul do Brasil. **Arch. Zootec.**, v.63, n.244, p.633-644, 2014. Disponível em: https://scielo.isciii.es/pdf/azoo/v63n244/art7.pdf

MINISTÉRIO DA AGRICULTURA, PECUÁRIA E ABASTECIMENTO (MAPA). **Projeções do Agronegócio: Brasil 2019/20 a 2029/30** - Projeções de Longo Prazo. Secretaria de política Agrícola. 102p. 11ª edição. 2020,

MORAES AS, ALVES FV, JULIANO RS, FIORAVANTI MCS, LOPES JCS, BARCELLOS GP, ABDO Y. Percepções de consumidores sobre carne bovina com indicação geográfica de raças locais brasileiras, Campo Grande-MS. **ANAIS...** IN: 6º Simpósio sobre recursos naturais e socioeconômicos do Pantanal. 6p. Corumbá, MS, 26 a 29 de novembro de 2013.

OLIVEIRA NM, STRASSBURG U. Notas sobre a desigualdade social no Bico do Papagaio – Tocantins. **DESAFIOS: Revista Interdisciplinar da Universidade Federal do Tocantins** – v. 1, n. 01, p. 130-148, jul/dez. 2014. DOI: http://dx.doi.org/10.20873/uft.2359-3652.2014v1n1p130.

RODRIGUES SCS, RODRIGUES W. Estimativa do valor econômico de reservas ecoturísticas na Amazônia Legal: o caso do Jalapão, Estado do Tocantins. Amazônia: ***Ci. & Desenv.***, Belém, v. 3, n. 6, jan./jun. 2008.

SALLES PA, MEDEIROS GR, COSTA RG, RAMOS CTC, BORBUREMA JBA, ROCHA MJO, ROCHA LL, MATHIAS W. Programa de conservação e melhoramento de uma raça bovina Brasileira: Curraleiro Pé-Duro. **AICA-Actas Iberoamericana de Conservacion animal, Córdoba**, v. 1, n. 1, p. 453-6, 2011. Disponível em: www.insa.gov.br/wpcontent/uploads/2013/.../Documento-técnico_5.pdf.

SALLES PA, MEDEIROS GR, COSTA RG, RAMOS CTC, BORBUREMA JBA, ROCHA MJO, ROCHA LL, MATHIAS W. Programa de conservação e melhoramento de uma raça bovina Brasileira: Curraleiro Pé-Duro. **AICA-Actas Iberoamericana de Conservacion**

animal, Córdoba, v. 1, n. 1, p. 453-6, 2011. Disponível em: www.insa.gov.br/wpcontent/uploads/2013/.../Documento-técnico_5.pdf.

SERVIN AEM, BRITEZ GDV, DUARTE NDL, DUARTE CRL. Caracterización del consumo de la carne bovina con indicación geográfica en Paraguay. **Revista Desenvolvimento, Fronteira e Cidadania**, v.3, n.1, p.12-26, 2019. Disponível em: https://periodicosonline.uems.br/index.php/fronteiracidadania/article/view/3212

SILVA, M.C.; FIORAVANTI, M.C.S.; SOLANO, G.A.; SILVA D.C.; ISKANDAR G.R.; MOURA, M.I. ROCHA F.E.C.; LOPES, F.B.; SERENO, J.R.B. Análise do discurso em reunião para o registro genealógico de bovinos Curraleiro Pé-duro no Brasil **Actas Iberoamericanas de Conservación Animal**, v.3, p.188-193, 2013. Disponível em: https://repositorio.bc.ufg.br/handle/ri/13613

SOUZA LB, BARROS JR. Agronegócio e ambiente no Cerrado tocantinense: um panorama dos municípios com base em indicadores. **Ateliê Geográfico** - v. 13, n. 1, p. 124 – 149, 2019. DOI: https://doi.org/10.5216/ag.v13i1.51961

VALE, P., GIBBS, H., VALE, R., CHRISTIE, M., FLORENCE, E., MUNGER, J., & SABAINI, D. The expansion of intensive beef farming to the Brazilian Amazon. **Global Environmental Change**, v. 57, p. 101922, 2019. DOI: https://doi.org/10.1016/j.gloenvcha.2019.05.006.