

## LIVESTOCK RECONVERSION: a possible trajectory for the sustainability of cattle production in Maranhão, Brasil

### RECONVERSÃO PECUÁRIA: uma possível trajetória para a sustentabilidade da produção de bovinos no Maranhão - Brasil

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#### ABSTRACT

The cattle production systems in Brazil are based on the use of pastures, but due to the seasonality of forages during the drought period, meat production is significantly reduced. Livestock in Maranhão has low productivity when compared to other states, with the level of adoption of insufficient and ineffective technologies, generating instability in the supply of meat and its products and in the income of producers. The introduction of more ecological and sustainable management has been increasingly used to optimize meat production without promoting degradation of the area, within the methodologies the Silvopastoral System (SSP) stands out for reducing expenses with fertilizers, favors the performance of animals by reducing the thermal stress caused by high temperatures and promotes greater income to the producer for presenting higher revenues from the sale of animals and trees.

**KEYWORDS:** Grass-leguminous Intercropping; Performance; Sustainability; Silvopastoral Systems

#### RESUMO

Os sistemas de produção de bovinos no Brasil estão baseados no uso de pastagens, mas devido a sazonalidade das forrageiras durante o período da seca a produção de carne sofre redução significativa. A pecuária maranhense apresenta baixa produtividade quando comparadas a outros estados, com nível de adoção de tecnologias insuficientes e ineficazes gerando instabilidade na oferta de carne e seus produtos e na renda dos produtores. A introdução de manejos mais ecológicos e sustentáveis vem sendo cada vez mais utilizados para otimizar a produção de carne sem promover a degradação da área, dentro das metodologias o Sistema Silvopastoral (SSP) se destaca por reduzir gastos com adubações, favorecer o desempenho dos animais por redução do stress térmico provocado pelas altas temperaturas e promove maior renda ao produtor por apresentar maiores receitas com a venda dos animais e árvores.

**PALAVRAS-CHAVE:** Consorciação Gramínea-leguminosa; Desempenho; Sustentabilidade; Sistemas Silvopastoris.

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## INTRODUCTION

The production of beef cattle in Brazil has been challenged to establish production systems that are capable of efficiently producing good quality meat at a low price. In addition, these systems must be competitive, sustainable and capable of reducing the age at slaughter to 30 months, considerably increasing the enjoyment rate in Brazil, which presents unsatisfactory values. Brazil stands out on the world stage as the holder of the largest commercial cattle herd in the world with 213.5 million cattle units (IBGE, 2019). According to the Ministry of Agriculture, Livestock and Supply (MAPA), the country has been leading beef exports since 2008, and in 2019 it exported a volume of 1.84 million tons, generating an income of US \$ 7.59 billion (ABIEC, 2019).

The southwestern region of Maranhão has the potential to develop more modern livestock, mainly because it is located in the Mid-North, a region with less influence of the climate and its variations when compared to the other states of the Northeast region (CARNEIRO et al., 2020). Livestock in Maranhão has low productivity when compared to other states, with the level of adoption of insufficient and ineffective technologies, generating instability in the supply of meat and its products and in the income of producers. Therefore, it is necessary to take measures for greater uniformity in production and search for greater profitability in the production chain.

The meat production systems in Brazil have in common the use of pastures as a basic substrate. In this context, it appears that the weight gain follows the seasonality of the forage production, which is reflected in the meat supply curve, with higher yields occurring during the rainy season and reductions in the production potential during the dry season of the year; with the animals reaching slaughter weight later, on average 4 and a half years. According to Garcia et al. (2014), seasonality is the main cause of low cattle production in the tropics, promoting inadequacy in meeting the animals' nutritional requirements.

Therefore, measures are needed to increase production uniformity and increase profitability in the production chain. The change in livestock management is a method of intensifying production that seeks to enhance the production of cattle, among the systems that have been used we have the Silvopastoral System (SSP). We must use resources that promote an increase in meat production, such as changes in livestock management. SSI is the interaction of trees, pasture and cattle in an area managed in an integrated manner, promoting greater meat production per hectare. Livestock reconversion seeks to increase the performance of animals through the natural resources of the area, reducing the degradation of the area by adequate and sustainable management.

Rotational management favors the production of roughage by allowing forage to regrow with the necessary time, with the consumption of cattle being made at the ideal time for maximum nutritional quality and with production consistent with the forage support capacity, reducing the seasonality of pasture production and possible management errors such as sub-pasture and super-pasture that promote agricultural and biological degradation of the area.

The use of legumes in the feeding of ruminants is essential in the reconversion of livestock, as it promotes superior gains when compared to the consumption exclusively of grasses, so its use in an SSI is a viable alternative for better performances. Legumes improve the production, quality and sustainability of pastures (LAMBERT & CLARK, 2005), sequester carbon (KANNINEN, 2001), they increase biodiversity (MacADAM et al., 2005), reducing possible environmental changes that may harm the performance of animals (DIAS, 2005) and are protein sources for ruminants, optimizing animal production. Most of the beneficial effects of legumes are derived from the ability to fix atmospheric nitrogen (DIAS et al., 2007). In the

reconversion of livestock, the use of different forages with the production of edible mass of high quality is optimized to favor the gain of the animal during the year, one of the alternatives is the use of forages with high productive value of biomass, as botão de ouro (*Tithonia diversifolia* (Hemsl) (CALSAVARA et al., 2016).

Botão de ouro (*Tithonia diversifolia* (Hemsl) A. Gray (Asteraceae) is a herbaceous plant belonging to the Asteraceae family, known as honey flower, daisy, Mexican sunflower, mini sunflower, hand-of-god, and Japanese boldo. It has great potential for use in the feeding of ruminants in Maranhão, due to its adaptation to the region with nutritional characteristics maintained for possible use in consortium with grasses in silvopastoral systems, increasing meat production in the dry season.

## HISTORY

In the early 1960s, in the city of Carlos Chagas (MG) more specifically on the Palestinian farm, the rural producer, Levy Cangussu, set fire to all the farm's pastures, a common practice at that time to "clean the pastures". However, the rains were delayed and the forage sprouts were unable to feed the herd, consequently, the animals started to starve. This harmful practice to the farm, the environment and the animals triggered a deep reflection by the owner, resulting in his self-condemnation throughout the generated scenario. Later, it was decided by him that he would never again set fire to pastures.

Over the years, without using the practice of burning, he realized that fire was not necessary, on the contrary, he realized that the absence of this practice increased the farm's forage production. In addition, the absence of fire allowed the regeneration of native trees and the formation of pastures with trees and surplus. Over the years, the management of pastures without the use of fire has been confirmed by several scientific studies.

In 1979, his son graduated in Veterinary Medicine and, from experience gained during the years of living with his father in the management of the farm, he adopted the teachings with respect to the environment and understanding, at this time, the importance of trees as a component of pastures. In the late 1980s, part of the family migrated livestock activities to the State of Maranhão, due to the opportunity to purchase land and expand the herd. However, this change needed the adaptation of the production system previously adopted to the Amazonian climate, that is, hot and humid, with precipitation between 1.600 and 2.000 mm annually, average annual temperature of 30 °C with maximum values around 37 °C. As for Maranhenses soils, they were less fertile compared to the one found in the State of Minas Gerais. This was the scenario that started the Monalisa Farm (FML) which remains today with the same owner. When acquired (1995) the FML was already completely deforested with all "clean" pasture areas, a management model used extensively in the region and locally called "soccer field", distributed in 783 (Figure 1).



Figure 1. Monalisa Farm in 1995. São Francisco do Brejão, Maranhão.

## EXCHANGE DEVELOPMENT ACTIONS (MARANHÃO - MINAS GERAIS AND COLOMBIA)

Since the beginning of the implantation and management of pastures at FML, the fire has been completely abolished and the remaining trees have been preserved. The pasture areas were divided into paddocks which had troughs for mineral salt and water, following the principle that “water goes to the animal and not the other way around”, the water resource of underground origin was distributed to all paddocks through drinking fountains, reducing the influence of water from rain in drinking fountains dug in pastures, it is often seen in the region. Due to the owner's previous experience in the formulation and marketing of mineral mixtures for cattle, mineral complexes appropriate to the demands of the region were quickly developed. Based on the chemical results of soil, forage and water samples and technical support guidelines from the Veterinary School of the Federal University of Minas Gerais (EV-UFMG).

At the end of the 20th century, more precisely in 1999, a group of ranchers from Maranhão led by the owner of FML promoted a series of technical visits to various farms and institutions linked to the meat chain seeking technical updates. During the visit to EV-UFMG they developed knowledge of several projects and research on cattle nutrition and mineralization, forage and silvopastoral practices applied to the production of ruminants carried out at the Zootecnics Department. This visit, in addition to technical improvement, provided a technical / scientific partnership between EV-UFMG and FML involving several field trips and exchange of students and researchers.

In this phase (1999-2005) the potential of the property, the capacity of the residual seed bank of the old forest and remaining trees to regenerate the pastures with native trees was evidenced in the FML and consequently to promote the formation of silvopastoral systems without the need for planting. For this purpose, the system of annual clearing of pastures was also modified with intense preservation of trees undergoing regeneration and the conservation of the rest. As for the formation or recovery of existing pastures, this process involved the use of a heavy grid respecting the regenerating plants and using natural phosphating as the main fertilizer.

The impacts generated by the visit to EV-UFMG and more precisely by the reports of silvopastoral activities developed in Colombia by the Centro para la Investigación en Sistemas

Sostenibles de Producción Agropecuaria (CIPAV) (<http://www.cipav.org.co/>) and its immediate application in FML, reflected positively in the group of producers. In 2010, this group, together with other producers, technicians and researchers (11 participants), invited by CIPAV-Colombia, visited silvopastoral experiences in several small, medium and large Colombian farms, for 12 days. This trip was decisive not only by confirming the correct path taken by the FML, but also by convincing the *in loco* participants. During the outward journey, participants always discussed the importance of forages, suggesting new varieties and various fertilizers which were generally recommended.

However, after the trip the focus was different, that is, the discussion was about which tree species could be planted or even regenerated in the properties for simple superphosphate (SSP) composition in the transition region between the Cerrado and the Amazon Forest. Two opposite scenarios were evidenced, in Colombia the animals grazed in an environment completely dominated by shrub and grass trees where this environment of rich biodiversity provided a diet abundant in protein and energy but also thermal comfort and animal welfare.

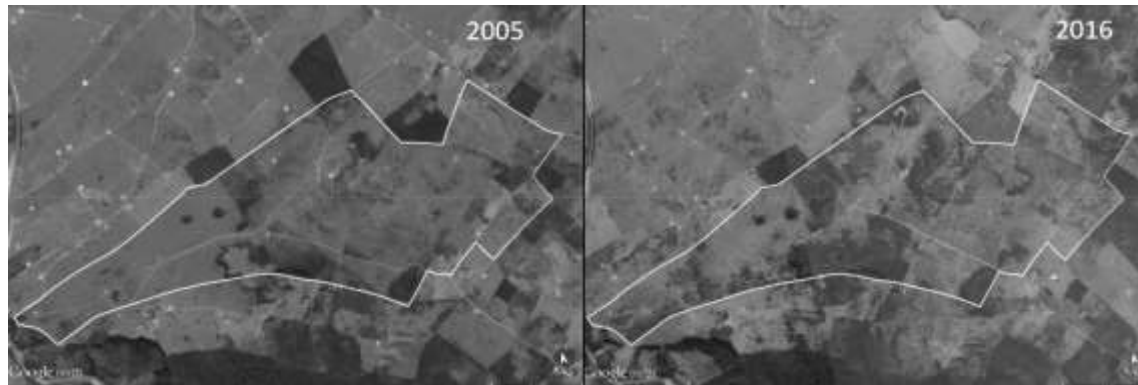
The fences were made up of tree species, resistant to the impact of cattle, with extreme durability and capable of providing food (leaves and branches) and protection against the wind. The paddocks were managed with electric fences maintained by low-cost solar panels. Animal load, for example in systems composed of leucena (*Leucaena leucocephala*) and grass plants, comprised 4 to 5 AU / hectare. Systems in production with more than 20 years of use without maintenance fertilizers were observed.

In addition to the high biomass production of the undergrowth and shrub extract, trees such as teca (*Tectona grandis*) or even eucalyptus (*Eucalyptus grandis*) were also part of the system aiming at the production of wood or even reducing the dehydration of forages by the wind (MURGUEITIO et al., 2011). After contact with this whole scenario for the production of cattle in line with environmental conservation and high economic profitability, producers began a process of implementing these systems in several properties including FML.

## TOCANTINA REGION OF MARANHÃO SUSTAINABLE DEVELOPMENT

Pastures under the regeneration process of native trees practiced at FML as well as the preservation of native forest remnants (Figure 2). It was observed that animals managed in wooded areas showed calmer behavior and reduced caloric stress. A lower incidence of external parasites was observed which led to the decision to suspend the use of all ecto-parasitic drugs on the property. At the same time, due to the low presence of internal parasitic load, the use of homeopathic medicines to control was adopted.

In 2012, 5 hectares of silvopastoral system with leucena and coloniz grass (*Panicum maximum*) were formed at FML following the Colombian model which lasts until today with an average load of 4 UA. Each paddock was delimited by specimens of the tree species gliricidia (*Gliricidia sepium*), in a rotated system with access to mineral mixture and artesian well water.



**Figure 2.** Evolution of the silvopastoral area from 2005 to 2016 (Source: Guilherme Ponciano 2017).

The whole process stimulated participation in congresses and scientific events related to the theme, in search of greater knowledge. In this way, trips were made to India (silvopastoral systems in Jaipur), Colombia (Silvopastoral Congress), Mexico (Silvopastoral Congress). In 2015, in an event promoted by the Food Agriculture Organization (FAO) in France, the FML was presented as a case study, and used in a publication by the Global Agenda for Sustainable Livestock (MAURICIO et al., 2019).

Based on scientific information originating from work developed in Colombia and Mexico and later by the Department of Biosystems Engineering at the Federal University of São João Del Rei (UFSJ) on the botão de ouro (*Tithonia diversifolia*) (Sandim et al., 2016) was recently implanted in FML 50 hectares of this forage intercropped with eucalyptus and colônia grass.

After several successive observations of leafhopper infestations (*Mahanarva spectabilis* (Distant) (Hemiptera: Cercopidae) in FML silvopastoral pastures and neighboring areas, their intense death due to parasitic fungi attack was evidenced. It is noteworthy that this fact was not repeated in the forage monoculture pastures in neighboring farms, on the contrary, the attack promoted an intense death of the grasses. From the collection of parasitized leafhopper, the fungi were isolated and identified by morphological and molecular analysis at the Department of Biosystems Engineering at UFSJ in partnership with the Institute of Biological Sciences at UFMG. Six fungi were identified, two of which showed a virulent action superior to the commercial strain of *Metarhizium anisopliae* (Metschn.) frequently used for biological control of insects. Currently, other trials are already evaluating the propagation and application process to control this pest on a large scale. This study demonstrated that systems with high biodiversity such as the FML silvopastoral systems can provide environmental services which will support the search for sustainable livestock in the state of Maranhão.

In an attempt to strengthen the search for sustainability in livestock production in the region to which FML belongs and with the support of local producers, many of whom were part of the first visit to Colombia in 2010, met and decided to create the Brazilian Center for Sustainable Livestock (CBPS) (<http://www.cbps.org.br/>) aiming to disseminate and support silvopastoral initiatives which could contribute to changes in the ruminant production sector.

The advances made at FML aim to achieve full “livestock reconversion”, a term used on the farm that according to the Aurélio dictionary is the act of transforming something that had already been transformed. For the reconversion, pasture management practices are used in order to seek as much as possible, when possible, the resemblance of the original ecosystem. This whole process culminated with CBPS joining the Global Agenda for Sustainable Livestock (GASL) after the last event held in Ethiopia (<http://www.livestockdialogue.org/events/events/multi-stakeholder->

meetings/addis-ababa-08-12-may-2017 / posters / en /) where CBPS was formally included as an active partner in the search for sustainability of cattle production in Brazil by GASL (<http://www.livestockdialogue.org/partners/en/>).

## FINAL CONSIDERATIONS

Pasture degradation persists in several Brazilian regions and, in this way, national livestock has been criticized, which can be circumvented mainly by the vast plant biodiversity of the tropical world, which when understood can be a decisive factor in the reconciliation between animal production and environmental conservation. The livestock reconversion process has advantages when compared to traditional forms of meat production, such as reducing the use of medicines, fertilizers and supplements. Feed efficiency is favored by producing food with better protein-energy input due to the vast production of edible legumes and the presence of the botão de ouro (*Tithonia diversifolia*), in addition to an environment with a better thermal comfort zone. The most sustainable production and with greater environmental concerns is increasingly sought and valued financially by the consumer market making the process irreversible, so greater incentives and dissemination of knowledge to traditional producers are necessary for greater adhesion and acceptance of sustainable meat production in Brazil.

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