revista online de extensão e cultura
REALIZAÇÃO

DOI 10.30612/realização.v10i20.17719
ISSN: 2358-3401

Submetido em 18 de novembro de 2023
Aceito em 05 de dezembro de 2023
Publicado em 31 dezembro de 2023

SILVIPASTORY SYSTEM IN AREAS OF SMALL RURAL FARMERS IN MATO GROSSO DO SUL

SISTEMA SILVIPASTORIL EM ÁREAS DE PEQUENOS AGRICULTORES RURAIS NO MATO GROSSO DO SUL

SISTEMA SILVIPASTORIO EN ZONAS DE PEQUEÑOS AGRICULTORES RURALES EN MATO GROSSO DO SUL

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Abstract: The use of Silvopastoral systems combined with crop farming, livestock, and forestry creates a sustainable environment, improving socioeconomic and environmental characteristics, enhancing the productivity system, and the quality of life for rural families. The tree species of the silvopastoral system bring the diversification of sources of income, ensuring, at the same time, environmental functions that allow the maintenance of fertility and the increase in the productive characteristics of the soil, improving the physical-chemical characteristics of the soil, in addition to providing shade for animals, improving their well-

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being and consequently their performance. The extension action has been developed on lot 47, in the Cabeceira do Rio Iguatemi settlement, located in the municipality of Paranhos – Mato Grosso do Sul, where a demonstration unit was set up combined with the development of various social activities involving producers and the community academic and other management actions such as planting tree components and production of organic fruit and vegetables. Maintenance of the area is carried out monthly, in accordance with the instructions of the responsible technician and professors at the Federal University of Grande Dourados-UFGD. With the development of activities, there was a notable improvement in animal/vegetable production on the property with the integrated implementation of systems, in addition to an improvement in the quality of life of those involved. It is possible to observe a great interest from new settlers in maximizing the use of land in a rational way.
Keywords: Community, Reforestation, Crop-Livestock Integration.

Resumo: A utilização do Sistemas Silvipastoril associado à lavoura, pecuária e floresta, cria um ambiente sustentável, melhorando as características socioeconômicas e ambientais, melhorando o sistema produtivo e a qualidade de vida da família rural. As espécies arbóreas do sistema silvipastoril trazem a diversificação das fontes de renda, assegurando, ao mesmo tempo, as funções ambientais que permitem a manutenção da fertilidade e o incremento nas características produtivas do solo, melhorando as características físico-químicas do solo, além de fornecer sombra aos animais, melhorando o bem-estar e consequentemente o desempenho dos mesmos. A ação de extensão vem sendo desenvolvida no lote 47, no assentamento Cabeceira do Rio Iguatemi, localizado no município de Paranhos – Mato Grosso do Sul, onde foi montado uma unidade demonstrativa aliado ao desenvolvimento de diversas atividades de cunho social envolvendo os produtores e a comunidade acadêmica e outras ações de manejo como plantio dos componentes arbóreos e produção de hortifrutis orgânicos. A manutenção da área é realizada mensalmente, conforme as orientações do técnico responsável, e dos professores da Universidade Federal da Grande Dourados-UFGD. Com o desenvolvimento das atividades, houve melhoria notável na produção animal/vegetal na propriedade com a implantação integrada dos sistemas, além de uma melhoria na qualidade de vida dos envolvidos. É possível observar um grande interesse de novos assentados de maximização da utilização da terra de forma racional.

Palavras-chave: Comunidade, Reflorestamento, Integração Lavoura-Pecuária.

Resumen: La utilización de sistemas agrosilvopastoriles asociados con cultivos, ganadería y bosques crea un ambiente sostenible, mejorando las características socioeconómicas y ambientales, fortaleciendo el sistema productivo y la calidad de vida de la familia rural. Las especies arbóreas del sistema silvopastoril traen la diversificación de fuentes de ingresos, asegurando, al mismo tiempo, funciones ambientales que permiten el mantenimiento de la fertilidad y el aumento de las características productivas del suelo, mejorando las características físico-químicas del suelo, además de proporcionar sombra a los animales, mejorando su bienestar y en consecuencia su rendimiento. La acción de ampliación se desarrolló en el lote 47, en el asentamiento Cabeceira do Rio Iguatemi, ubicado en el municipio de Paranhos – Mato Grosso do Sul, donde se instaló una unidad demostrativa combinada con el desarrollo de diversas actividades sociales que involucran a los productores y a la comunidad. acciones académicas y otras de gestión como la plantación de componentes arbóreos y la producción de frutas y hortalizas orgánicas. El mantenimiento del área se realiza mensualmente, de acuerdo con las instrucciones del técnico responsable y de los profesores de la Universidad Federal de Grande Dourados-UFGD. Con el desarrollo de las actividades se logró una notable mejora en la producción animal/vegetal del predio con la implementación integrada de sistemas, además de una mejora en la calidad de vida de los involucrados. Es posible observar un gran interés por parte de los nuevos pobladores por maximizar el uso de la tierra de manera racional.

Palabras clave: Comunidad, Reforestación, Integración Cultivos-Ganaderos.

INTRODUCTION

Silvopastoral systems are characterized by being a sustainable production practice, incorporating trees into the creation of production animals in the same area. Being an alternative, considered favorable to the simultaneous development of different cultures in the same area, adding value to the land, increasing family income, contributing to the conservation of the local environment (CRUCIOL, 2021).

For the environment, the silvopastoral system creates an ecological corridor, increasing local biodiversity, in addition to improving the physical, chemical and biological characteristics of the soil, reducing erosion and improving nutrient cycling. In an economical way, it increases animal production per area, improves climatic conditions for animals, in addition to producing wood, which can be used on the property itself or sold, generating income for the producer (PERI; DUBE; VARELLA, 2016).

The silvopastoral system is considered a good alternative to be implemented in rural settlements, as it offers economic and environmental benefits, in addition to generating production diversification, improving family income and quality of social life (SILVA et al., 2023).

Rural settlements in the state of Mato Grosso do Sul have an average of 15 hectares, where this area is used for raising animals and producing short-cycle crops (MONÇÃO et al., 2012). However, on many properties, the settlers received these deforested areas, with bare soils, with an absence of organic matter and nutrients essential for the good development of crops and pastures, which reduces production per area, consequently generating less profit, which which can generate an increase in rural exodus (OLIVEIRA et al., 2020).

To improve soil quality, the implementation of silviopastoral systems has been identified as an option to recover degraded areas, improving land use, local biodiversity, as well as improving the comfort and animal welfare, and the quality of life of the settlers (SILVA et al., 2023).

In the silviopastoral system, the association of crops and animals brings a significant ecological gain, since the requirements of plants and animals are respected, simultaneously with the environment, which guarantees that activities are developed in sustainable ways (MONAÇÃO et al., 2012).

In this way, producers are able to guarantee adequate environmental conditions for their pastures and livestock, in addition to producing a supply of wood that can be used for property maintenance and the like, increasing their capacity to raise cattle and diversifying their sources of income.

In this context, the objective of this university extension action was to implement and evaluate the silviopastoral system on a rural property, located in the Cabeceira do Rio Iguatemi settlement, located in the municipality of Paranhos in the state of Mato Grosso do Sul.

MATERIAL AND METHODS

The Silviopastoral system was implemented on site 47, in the Cabeceira do Rio Iguatemi settlement, located in the municipality of Paranhos – Mato Grosso do Sul, in November 2017, using tree species native to the state, such as: *Anadenanthera macrocarpa*, *Schinus terebinthifolia*, *Stryphnodendron adstringens*, *Handroanthus, Cedrela fissilis, Pseudobombax grandiflorum, Enterolobium contortisiliquum*, as well as fruit species such as: *Psidium guajava, Hymenaea courbaril, Mangifera indica, Eugenia uniflora, Rubus subg. Rubus,* among others. Thinking about the rusticity of the plants due to the region's climate.

The Group was founded in 2016, and is currently made up of 13 families where they produce organic products, intended for self-consumption and commercialization, and the production of seedlings of native species, used both for the reforestation of lots and for commercialization.

The implementation of the silviopastoral system took place after a meeting, where the group looked for alternatives to improve the pasture area that was degraded, increase animal production per area, to improve income, arising from cattle farming. All group participants were present on the occasion. It was then decided to hold a draw among them and one was chosen to install a demonstration unit on one of their site.

The production of seedlings was carried out in the nursery belonging to the group of settlers, located in the community itself. The nursery produces seedlings for both group use and commercialization. This is a way for all group members to actively participate.

The selected producer donated one hectare of the property for the implementation of the system. The spacing was 5 x 5 meters between the plants. The contemplated producer, together with the group, cultivated*: Allium sativum, Allium cepa, Citrullus lanatus, Cucurbita, Ipomoea batatas, Arachis hypogaea, the Manihot esculenta* between the rows, in an organic production system, using humus, and cattle manure, as the main source of fertilizer, until that the plants were tall enough to plant pasture.

The soil on the property is of the Distrophic Red Argissol type (table 1), medium texture. For soil analysis, 20 soil samples were collected in a zig-zag pattern, and mixed in a bucket to form a composite sample. After analysis, fertilization was carried out using 5 kg of manure distributed in the pits and mixed with soil before planting. To help with the fixation of

the plants, it was necessary to irrigate via a plastic watering can with a capacity of 10 liters, once a day, until the plants showed satisfactory fixation.

Table 1. Chemical and granulometric characterization of the soil, at a depth of 0 - 20 cm, carried out at site 47, in the headwater settlement of the Iguatemi river, before implementation.

Local	pH $CaCl_2$	OMg/dm³	cmol / dm^3						
			$Ca2^+$	$Mg2^+$	K^+	H+Al	SB	CTC	V%
Site 47	4.57	10.75	1.60	0.76	0.07	2.87	2.43	5.30	45.8
	mg/dm³						g/kg		
	Sulfur S	Boron B	Iron Fe	Copper Ass	Manganese Mn	Zinc Zn	Clay	Silt	Sand
	3.14	0.20	95.42	0.35	26.40	0.10	150	70	780

[1]pH $CaCl^2$: hydrogenion potential in calcium chloride; OM: organic matter; Ca2+: calcium; $Mg^{2+:}$ magnesium; K^+: potassium; H+Al: potential acidity; SB: sum of exchangeable bases; CTC: effective cation exchange capacity; V%: saturation by bases.

When the plants reached around one meter in height, in 2019, top dressing was applied, using humus, produced by the group. In December of the same year, through a technical visit to the field, the delimbing procedure was recommended, so that the trees remain tall, providing adequate surplus, without harming the pasture.

The pasture was established in December 2019, the cultivar used was *Urochloa humidicola,* cultivar Comum. 5 crossbred dairy cows (Holstein x Zebu) were placed in the area, with calves, intended for milk production. The animals had an average production of 10 liters of milk/day.

The implementation is being carried out in stages. Visits are made monthly, through meetings with participants, and with professors and undergraduate and postgraduate students, at the Federal University of Grande Dourados -UFGD, in order to create spaces for discussion and exchange of experiences among the community.

Due to the covid-19 pandemic, the group's meetings in 2020 were held remotely, via calls on apps or via group messages. During the meetings, producers answered their

questions, and videos or photos were taken to help, to help the technician and teachers identify the problem. A stopover was also carried out to maintain social distancing.

The work is carried out with explanations and accompanied by a professional from the Silviopastoral system of the company SECAF – Consultoria e Assessoria para Agricultura Familiar and by the families of the settlers. The tasks are divided and carried out according to the schedule for the seasons.

RESULT AND DISCUSSIONS

The actions are bringing a new moment for farmers, who can, from this work, have in the same place, the growth of trees and the raising of animals, which express the potential in their income, through milk and meat for their survival in a more sustainable environment for agricultural and livestock management in the settlement.

The production of humus used is made up of cattle manure, dry tree foliage, and vegetable remains such as fruits and vegetables that will serve as food for earthworms, aiming to reduce fertilizer costs and increase production. In addition to enhancing the production of organic fruit and vegetables.

The organic fruits and vegetables produced in the area (Figure 1), both planted between the rows and fruit trees, are intended for self-consumption by families that are part of the group and the surplus is sold at the Association of organic producers of Mato Grosso do Sul - APOMS, generating added value by being organic, in addition, with this extension activity there is a greater retention of producers in the field, and a quality of life for everyone in the group.

Figure 1. Fruit and vegetables produced organically, in the introduction phase of the Silviopastoril system.

The tree seedlings planted in the area during the dry period in the region were not affected, as artificial irrigation was used, which guaranteed adequate growth, without delaying the animals' entry into the area.

Another factor that contributed considerably to the growth of the seedlings was adequate fertilization at all stages of plant growth and development. With the development of this new activity, it was possible to notice that there was a considerable improvement in the group's teamwork, even in difficult times such as the Covid-19 pandemic.

As the producer's animals are crossbred, they are highly adapted to climate and management conditions, due to high temperatures in the state, unlike regions with a temperate climate, a region characteristic of specialized dairy cattle breeds. However, as a result of this extension action, they have demonstrated that it is possible to raise animals on pasture, ensuring thermal comfort and well-being, even in very hot regions such as Mato Grosso do Sul.

Thermal comfort directly reflects the improvement of the productive and reproductive performance of dairy animals. Therefore, minimizing the harmful effects of high temperatures on animals has been a constant concern for producers, researchers and extensionists, aiming to reduce the negative action of climatic variables considered responsible for heat stress.

According to Alves et al. (2012), thermal stress in dairy cattle reduces the consumption of dry matter and nutrients, contributing negatively to reproductive and production performance, with shading being important when seeking to increase milk production and the number of births. per year, in cattle farming.

Natural shading is the most recommended, bringing several benefits, not only for the animals, but for the entire property, improving the quality of the pasture and soil, increasing local biodiversity, in addition to increasing water infiltration, which increases the availability of groundwater and surface water (ALVES et al., 2012).

With the implementation of the Silviopastoral system, the availability of forage for animals in the area increased throughout the year, as can be seen in figure 2. Even in the dry period of the year, the animals did not suffer food restrictions, maintaining production of milk, even on very hot days, such as the heat wave that occurred in September 2023.

Figure 2. Silviopastoral System in the Cabeceira do Rio Iguatemi settlement, with crossbred dairy cows.

The creation of dairy cows in the silviopastoral system aims to increase productivity in the area, since the use of different activities in the area allows for a more efficient use of land, increased nutrient cycling, as waste of cattle provide nutrients for plants, in addition to supplementing income, through the production of milk and calves after weaning.

With the creation of cows in the silviopastoral system, an increase of 30% in the average milk production of cows was observed, mainly in times of seasonality in forage production, compared to previous years. This increase is due to factors linked to the silvopastoral system, such as the better thermal comfort presented in the area, improvement in the quality of the soil, and consequently the forage.

Barros et al. (2019) verified the nutritional value and shear strength of *Urochloa brizantha* cultivar Xaraés, subjected to three light intensities, being: natural and reduced by 30 and 60%, they observed an increase in productivity and lower neutral detergent fiber contents, acid detergent fiber and lignin, under shade, and consequent lower shear force, compared to full sun.

One of the main challenges encountered for the occurrence of silvopastoral systems is the response of the pasture to shading. According to Sousa et al. (2022), Brachiaria grass has morphophysiological characteristics that make it well-adapted to shaded conditions, such as an increase in the shoot/root ratio, specific leaf area, and leaf elongation rate. This allows it to maintain productivity even under limited light conditions, making it one of the most commonly used cultivars in this production model.

Mendes et al. (2021), verified the economic forecast of agroforestry systems, in the north of Minas Gerais, in pasture areas with low productivity, operating the implementation of the system is economically viable, as long as there is adequate planning and the sale of eucalyptus occurs from 6 to 10 years.

From a socioeconomic point of view, another advantageous point of agroforestry systems is that in the short term, the fruits from the planted trees are serving as a source of extra income, and in the long term the trees can be exploited commercially, which increases the sustainability of the production model (CRUCIOL, 2021).

Agroforestry systems, combined with organic agriculture, are a great option for groups of family farmers, as they improve socio-environmental and ecological impacts, with the use of technologies introduced in the transition process for the system in general (OLIVEIRA et al., 2020).

Because the group already works with organic agriculture, the introduction of new technologies, such as the silvopastoral system, occurs more smoothly, which generated the interest of new producers to join the system on their properties.

However, the development of this extension action is due to the fact that the extensionists have already created a relationship of trust with the group, working directly with the farmers, already knowing their goals and values, highlighting the process of transferring technologies and knowledge, allowing generating development in the community and sharpening the interest of academics who assist in the actions developed, acquiring practical experience on how to deal with small farmers and thus resolve their difficulties, improving the quality of life of them and their families.

According to Muniz et al. (2021), a university rural extension action, in addition to improving production processes, bringing solutions to producers, combined with increased income, must be capable of strengthening society's ties with the university, bringing producers closer to students and the academic community in general. After evaluating the development of the system, and the participation of the academic community, it is clear that this action is positively transforming the lives of everyone involved.

CONCLUSION

The silviopastoral system improved the animal welfare, providing shade for the animals to stay in during the hottest periods of the day, positively influencing the cows' milk productivity due to greater forage availability throughout the year, thus improving the settler's income. providing greater fixation of men in the field.

With the system it was possible to recover degraded soils, in addition to increasing local biodiversity, and reducing deforestation pressure on native areas, in an attempt to increase productivity.

For the group, the implementation of the system benefited due to an increase in the quantity and quality of fruit and vegetable products, presenting a better distribution of production throughout the year. As for the academic community, students acquired technical knowledge about the system and how diverse cultures are integrated harmoniously.

ACKNOWLEDGMENT

To the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) and a Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) for the granting of the scholarship. Support from the Universidade federal da Grande Dourados, through the Dean of Extension and Culture (PROEC/UFGD); to the Technological Vocational Center in Agroecology and Organic Production in Mato Grosso do Sul and to UFGD's Participatory Knowledge Construction Center in Agroecology and Organic Production.

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