ROTATED GRAZING IN BRACHIARIA BRIZANTHA CV. MARANDU TO IMPROVE MILK PRODUCTION

ORIGINAL ARTICLE

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ABSTRACT

In dairy properties, in order for there to be an increase in profit, it is necessary to increase the efficiency of production factors, especially nutrition, which impacts the fixed cost. Increasingly, a balance is sought between the supply of feed and pasture. The rotational grazing method has been adopted by several producers, as it has good productivity in a smaller area. However, the pastures used in this type of grazing, despite their excellent quality, have higher nutritional requirements. The objective of this work was to carry out an economic analysis of the cost of milk production, through the implantation of rotational grazing, and exchange of native pasture for *Brachiaria brizantha cv.* marandu, on a family farm. This work was prepared in the city of Foz do Iguaçu. An area of 6300m^2 was used, divided into 28 paddocks of 225m^2 using an electric fence. The total cost of production was

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R$6,047.40, with a positive margin of R$5.143.61 per year. According to the results obtained in the economic analyses, it is concluded that the implantation of rotational grazing and the exchange of native pasture for *Brachiaria brizantha cv.* Marandu is a viable management, since the income generated by the sale of milk was sufficient to cover the total costs of production.

Keywords: Cost, Milk, Fodder, Picket, Handling.

1. INTRODUCTION

Brazil ranks fourth in the world ranking of milk production. In 2018, the Southern region accounted for 34% of the country's total production (ANUÁRIO LEITE, 2019). The state of Paraná alone this year produced an average of 4.37 billion liters of milk, of which western Paraná was responsible for 19% (IBGE, 2018).

Dairy cattle in the state of Paraná is a typical activity of family farming, representing approximately 85.1% of the state's producers (SEAB, 2018). Most of these producers use pasture as the main source of food for animals. The average area occupied with pastures in the state is 16.6 hectares (IPARDES, 2009).

Although Brazil stands out in milk production, its productivity is around 1,689 L/cow/year, which is lower than in the United States, China, Russia, Argentina, the European Union and New Zealand, which produce more than 3 L/cow/year. One of the factors responsible for low milk yield is the use of poorly productive grasses of low nutritional quality, together with inadequate management of both animals and pastures (GONÇALVES et al., 2003).

One way to intensify animal production in grazing systems is to the adoption of improved fodder, more adapted to the climate, with higher production potential and better quality (JANK, 2017). Among the various fodder existing in Brazil, stands out the hybrid variety of *brachiaria brizantha cv.* marandu grass, for presenting a good nutritional value and high biomass production, adapting well to soils of medium and good fertility, being tolerant to soil acidity (FONSECA et al., 2010).

The correct management of pasture should be another point to be observed in the properties of milk cattle. One of the grazing that has been shown to be viable is the rotational, where there is subdivision of the pasture into three or more pickets. This type of grazing has several advantages, such as: greater grazing uniformity, greater use of forages, higher stocking rate, and longer longevity of weeds that form clumps (FUKUMOTO et al., 2010).

Different studies have shown good results for dairy cattle, with the implantation of rotational grazing in *Brachiaria brizantha cv.* marandu grass (GONÇALVES, 2003); (DEMSKI, 2013), (MOURA, 2017). According to (ANDRADE, 2008), this type of pasture does not tolerate continuous grazing.

With the correct choice of forage, proper management and better use of the property area, it seeks to generate savings to the producer, since it will reduce the cost of production. According to (GERON, 2012), the cost of production is the sum of all the amounts spent on insumand operations and services used in the production process of a certain activity. With the study of costs, it is possible to verify how the resources used in a production process are being remunerated and how is the profitability of the activity (GERON et al., 2014).

Thus, the objective of this work was to perform the economic analysis of the cost of milk production, through the implementation of rotational grazing, and exchange of native pasture for pasture of *Brachiaria brizantha cv.* marandu, on a family farming estate.

2. MATERIAL AND METHODS

The experiment was carried out in a dairy property located in the city of Foz do Iguaçu - PR, Latitude: -25.5469, Longitude: -54.5882 25° 32′ 49" South, 54° 35′ 18"

West. This property is composed of an area of 5.0 hectares, in this area was developed a traditional dairy cattle to the region, where the animals had access to the entire grazing area, composed of native grass of low productivity, there was no availability of mineral salt, only common salt in the trough and being only available a supplementation at the time of milking of 10 kg of by lactating animals and access to water was from a stream that passes through the property.

The property has six dairy cattle, composed of four adult cows, two lactating cows and two dried cows, plus two heifers.These animals were managed throughout the pasture area throughout the year and the lactating animals received 10 kg of industrialized feed per day.

Work began with a visit to the property for a diagnosis. Measurements of the pasture area were performed using GPS (Figure 1) and also soil collection (Figure 2). The results of soil analysis are (Table 1).

Figure 1 - Satellite photo of the experimental area, with the demarcation of the pasture area:

Source: Google Earth.

Figure 2 - Soil sample collection:

Source: Personal Archive.

Table 1 - Results of soil analysis of the experimental area:

pH CaCl2	M.O	P (res)	K	Ca	Mg	Al	H+Al	CTC	SB	V	m	Ca	Mg	K
	g/Kg	mg/dm3	mmol/dm3					%			% CTC			
5,2	38	14	3	21	5	2,7	29	58	29	50	8	36	9	5

Source: FZEA/USP.

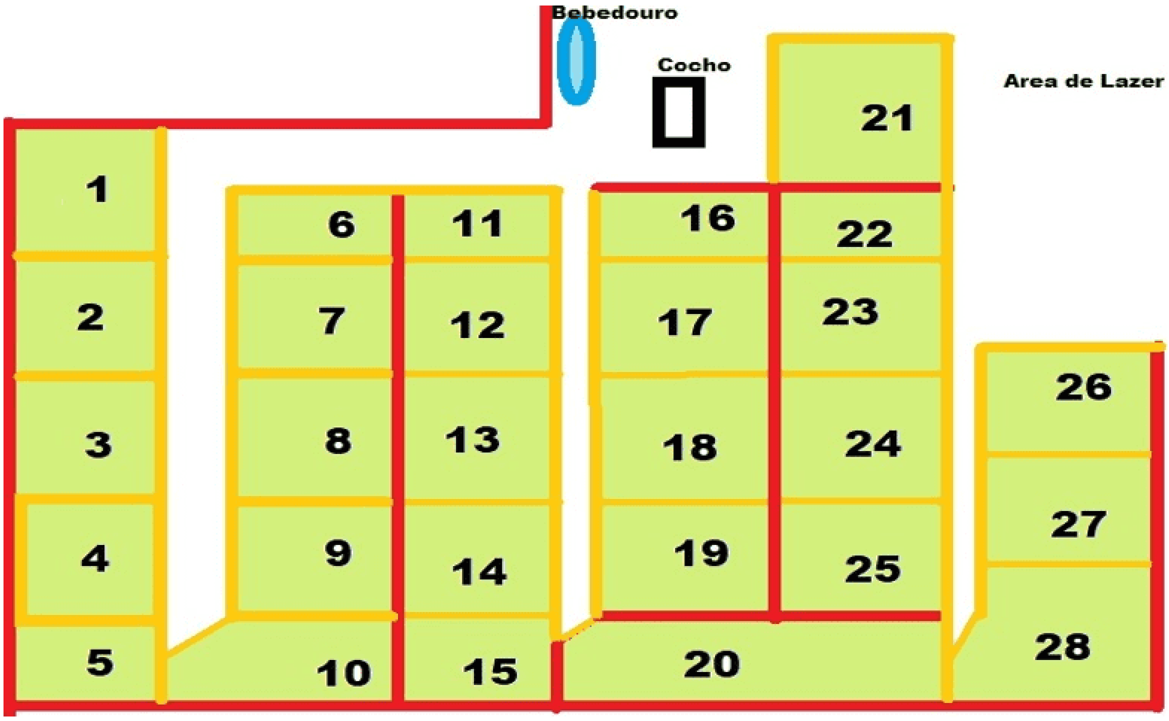
After receiving the soil analysis, soil correction calculations were made, where the V% was 58%. To correct the soil pH, 800 kg ha^{-1} of dolomitic limestone with 86% PRNT was necessary. To correct the phosphorus, it was necessary to add 250 kg ha^{-1} of simple superphosphate fertilizer. For the production fertilization, 250 kg ha^{-1} of agricultural urea was used (FRASSETO, 2015).

To start the soil preparation, the application of limestone was applied throughout the experimental area, and soon after, a heavy grid was used, with a depth of 40 cm, which served to incorporate limestone into the soil, break surface compactions and give conditions to the growth of the new forage species.

For a dimensioning of the area necessary for grazing, the cows were weighed using a weighing tape with 95% accuracy, totaling 1950 kg or 4.5 AU. Because dairy cattle are used, it was determined that the animals would have access to a new paddock at the end of a day of grazing. Therefore, data from (FRASSETO 2015) were used, in which an UA (450 kg live weight) needs at least 50 m^2 per day of grazing area. Knowing that there were 4.5 AU, the area of each paddock was 225 m^2. A total of 28 paddocks were built, using 0.63 hectares. During the construction of the pickets, it was necessary to add three corridors, 2m wide.

For the splitting of the pickets were used 50 mourões, 72 rebar of 10 mm, 32 rebar of 12 mm, 500 m of tri galvanized wire for about the total perimeter of the area and 2500 m of electroplastic wire for the internal division of the pickets, 150 insulators brown type, 22 hook insulators and 114 insulators type rebar. Wire wire with a height of 80 cm was used in relation to the ground and each 10 m a 1.5 m rebar with insulator was implanted to maintain the height in relation to the ground, electroplastic wire was also used to divide the pickets and reduce the formation costs. To electrify the wire, a Sentinel electrifier model 30,000 was used, with a minimum of 5000 volts.

Figure 3 - Sketch of the picket division:



Source: Personal Archive.

The forage chosen was *Brachiaria Brizantha cv.* marandu, the management of this forage starts when the plant reaches 30 cm at the entrance and 15 cm at the exit Andrade (2008); Fonseca (2010). Forage planting and planting fertilization began on 11/15/2019, with the broadcast planting method and incorporation of seeds and super-simple phosphate fertilizer afterwards. The seeds were incrusted, using 15 kg ha^{-1}.

The first production fertilization was carried out 60 days after planting, applying 125 kg ha^{-1} of agricultural urea with 45% nitrogen. The first grazing began on 02/03/2020, 77 days after planting. The second fertilization of production being applied 125 Kg ha^{-1} of agricultural urea was carried out in the first grazing cycle being 28 days after the beginning of the first grazing.

For the rest of the animals was added a water drinker with approximately 100 L of water, addition of mineral salt suitable for dairy cattle and the trees of the property themselves served as shading.

To perform the economic analysis and evaluation of the cost of milk production, we identified the agents involved, as well as the values that represent the effects of the implementation of the project on these agents, also considering the closing of one year.

To evaluate the cost of implementation of the project, we considered the costs of investing in soil preparation and planting of the grass, as well as investments for infrastructure and equipment in the formation of pickets.

To evaluate the cost of production, we used the structure of the operational cost of production, proposed by Matsunaga (1976). In which, the effective operational cost (COE), corresponds to the expenditure of money by the producer, with purchase of feed, expenses with the maintenance of pasture and medicines, for one year.

For the total cost of production (CTP), depreciation was added to (COE). The annual depreciation of the pasture was calculated by the sum of the supplies necessary for the construction of the electric fence divided over a period of ten years. Depreciation of 10% per year (CANZIANI et al., 2000).

To calculate revenue, net revenue was considered, which is the amount gained in milk delivery per year minus total production costs (MARTIN, 1997).

3. RESULTS AND DISCUSSION

Within agricultural production, it is necessary to have a planning by the producer, so that there is growth and development of the activity. Therefore, the first step in the study of the feasibility of a project is to survey expenses for its implementation. The costs for the implementation of this project, from the preparation of the soil for the planting of the pasture, to the formation of the pickets were R$ 3,023.70.

Before performing the implantation of grass *B. brizantha* cv. marandu, it was necessary to prepare the soil. Investments related to soil tillage are described in (Table 2).

Table 2 - Investment costs in soil preparation and planting:

Description	Unit	Quantity	Value (R$)
Soil Analysis	Uni	1	33,00
Dolomite limestone (PRNT 86%)	Kg	800	156,00
Superphosphate (00.19.00)	Kg	250	287,46
Tractor aration time	H	2	400,00
Encrusted seed	Kg	15	287,01
Agricultural Urea	Kg	250	400,00
Herbicide Glyphosate	Ml	500	35,00
Oil 2T	Ml	250	20,00
Fuel - Gasoline	L	5	20,00
Total			**1.638,47**

Source: Project Data.

The costs of soil tillage and planting represented 54.20% of the total costs for pasture implantation. Corrective practices and soil fertilization are only part of the requirements necessary for the success of the pasture production system (PEREIRA et al., 2018).

It is important for the producer to invest and perform a good soil preparation and a correct implementation of the pasture, always seeking balance in the soil-plant-animal system (PEREIRA et al., 2018). These managements will influence the increase of animal production, as well as in the reduction of feed expenses for animal feed.

In the search for a correct management of the pasture, it was subdivided into pickets. Investments for infrastructure and equipment in the formation of pickets are represented in (Table 3).

Table 3 - Cost table for the formation of pickets, with the electric fence:

Description	Unit	Quantity	Value (R$)
Eletrix wire	m	500	184,00
Electroplastic wire 500 m	m	5	104,82
Brown insulator	Uni	150	176,98
Rebar insulator	Uni	114	131,65
Short hook type insulator	Uni	20	24,00
Long hook-type insulator	One	2	4,60
Switch switch	One	3	36,00
Rebar (3/8") 1.5 m	One	72	284,30
Rebar (1/2") 1.5 m	One	2	186,18
PVC tube 20 mm 6 m	One	1	12,80
Digital voltmeter	One	1	139,90
Electrifier	One	1	100,00
Total			**1.385,23**

Source: Project Data.

The costs of infrastructure and equipment for the formation of pickets represent 45.80% of the total costs of the implementation of the pasture. The rational management of forage has widely demonstrated the benefits of dividing pastures, where there is a greater uniformity of grazing, greater utilization of forages, higher stocking rate, and greater longevity of weeds that form clump (FUKUMOTO, 2010), which is the case of *B. brizantha* cv. marandu. The use of the electric fence, in its different forms in picketling, is a necessary tool to implement at low cost the subdivisions that rotational grazing requires (EMBRAPA, 1999).

The assets that make up the enterprise are subject to constant devaluations, mainly due to wear and tear, and aging. (Table 4) has the depreciation data of the electric fence.

Table 4 - Depreciation of materials and equipment:

Description	Total amount R$	Shelf life (years)	Annual value
Electric fence construction	1.385,25	**10**	138,52

Source: Project Data.

Table 5 - Investment payment:

description	Total amount R$	Payment time (years)	Annual value
Deployment cost	3,023.70	**10**	302.37

Source: Project Data.

To have greater annual control over business management, investments for deployment was divided into 10 years. 4.20% of the annual revenue from the sale of milk, described in (Table 5).

To calculate the monetary intake, in the form of money in one year, it was considered the amount paid to the producer per liter of milk, sold daily and direct from the form producer for one year. To calculate the amount of annual milk was considered a daily milking in the morning with a total of 10 liters/day (Table 6).

Table 6 - Revenue from the sale of annual milk:

Variables	Total value
Price per liter (R$)	2,00
Total liters of milk produced (L)	3.600,00
Final revenue (R$)	**7.200,00**

Source: Project Data.

Each year the producer will have to make an expenditure of money, which is considered an Effective Operational Cost (COE). The costs of feed, expenses with the maintenance of pasture and medications were taken into account (Table 7).

Table 7 - Effective Operating Cost - COE, per year:

Description	Unit	Quant	Unit value R$	Total amount R$
Ration	Kg	720	1,32	950,04
Agricultural urea	Kg	250	1,60	400,00
Electrical energy	R$	12	0,60	216,00
Brucellosis vaccine	Dose	6	1,62	9,72
Rabies vaccine	Dose	6	1,48	8,88
Dectomax 50 mL	Uni.	1	21,90	21,90
Foot-and-mouth disease vaccine	Dose	6	1,50	9,00
Total				**1.615,50**

Source: Project Data.

It is observed in this work that the largest expenditure on production is on feed. According to (MARTINEZ, 2009), spending on nutrition represents on average 67% of milk production costs in Brazil. Thus, strategies are sought to reduce the use of diets and other supplements. Improving pasture and managing it is an alternative that helps milk production be economically viable. For this reason, rotational grazing has been increasingly indicated (MARION et al., 2010).

Rosestolato (2015), when analyzing the economic viability of milk production of two distinct properties regarding the technological production system, observed that the (COE) on the property in which the cows were kept in a continuous grazing system and supplemented with concentrated feed and mineral salt was higher than that maintained in a rotational grazing system and supplemented with chopped sugarcane, concentrated feed and mineral salt.

In the property evaluated in this study, 10 kg of industrialized feed was given per lactating animal and after the implementation of the project there was a decrease of 9 kg starting to offer only 1 kg of feed to the animals, thus decreasing the (COE), as observed by Rosestolato (2015). However, supplementation to animals even with the change in grazing system is important, since it helps to supply in animals the nutrients that are lacking in the composition of the fodder. The cost of the feed represented 44.70% of all production costs.

Considering the depreciation and effective operating cost (COE) values, the total cost of production was obtained in one year (Table 8).

Table 8 - Total Cost of Production - CTP (Annual Basis):

Description	Total amount R$
Depreciation	138,52
COE Costs	1.615,50
Investment	302.37

payment	
Total	**2.056,39**

Source: Project Data.

In countries with low milk prices, producers are able to reduce the cost of production by increasing the participation of pasture in the diet of dairy cows. In this study, the total cost of production represented 28.55% of annual income.

To calculate revenue, net revenue was considered, which is the value gained in milk delivery per year minus total production costs (Table 9).

Table 9 - Revenue (Annual Basis):

Description	Total amount R$
Revenue	7.200,00
Total Production Cost (CTP annual basis)	2.056,39
Balance	**5.143,61**

Source: Project Data.

According to Oliveira (2007), knowledge of the implications of the effective operational cost (COE), in the short term, is fundamental in the management of the business, and the gross margin needs to be positive, if negative, the interruption of production is recommended.

The financial analysis of the implementation of this project proved to be feasible (Table 9). In view of the analyses made from the data obtained, it was observed that the investment in the rotational grazing technique in dairy cattle presents an economically viable return on invested capital and that the same positive influence on production making this activity more competitive in the sector. Thus this technique allows the potential expression for milk production and the increase in the profitability of producers, which would make the dairy activity profitable, even in times of fall in the price of milk.

4. FINAL CONSIDERATIONS

According to the results obtained in the economic analyses, it is concluded that the implementation of rotational grazing and the exchange of native pasture by *Brachiaria brizantha* cv. marandu, is a viable management, since the revenues generated by the sale of milk were sufficient to cover the total costs of production.

This semi-intensive production system is recommended to the local reality, because it is an alternative of technological innovation, capable of reducing expenses with the purchase of feed, and providing a good animal performance, from the change of grazing management and grass insertion of better nutritional value and higher mass production.

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