

AUTOMATION DESIGN AND MECHANICAL TECHNIQUES IN PASTURE MANAGEMENT



10.56238/edimpecto2025.015-001

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ABSTRACT

The article proposes a fictitious but feasible project of a small mechanized and sustainable dairy farm in Pouso Alegre (MG), focusing on the rational management of pastures and the production of Jersey milk. The simulation considers an area of 5 hectares, distributed between corn cultivation, Mombasa grass, and management infrastructure. The planning covers annual goals related to genetic improvement, nutrition, sanitary management, formulation of specific diets by animal category, and herd sizing. The proposal prioritizes sustainable practices, such as the use of manure and its production of roughage and concentrates, in addition to having the support of public programs such as PROGEN. The model stands out for its low cost, simplicity in facilities, and potential for food self-sufficiency, making it a practical and profitable alternative for small producers.

Keywords: Dairy farming. Agricultural mechanization. Sustainability. Small rural property. Pasture management.

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INTRODUCTION

Mechanization in pasture management has become a fundamental strategy to optimize production and sustainability in agriculture. By using specific machinery and equipment, it is possible to perform tasks such as soil preparation, sowing, fertilization, and pasture maintenance more efficiently and with less manual effort. This approach not only increases productivity but also contributes to soil conservation and the rational use of natural resources, promoting a more sustainable and profitable management of pasture areas.

GOALS

GOAL 1

We worked with the simulation of a small property, because it is in these that there is a great lack of information and greater difficulty in finding help. After all, as they do not give very high profits, they do not attract the attention of large companies or the government.

The available area was 5 hectares, where it was destined: 3 hectares for the planting of corn, 1.5 hectares for the plantation of *Panicum maximum* cv. Mombasa and 0.5 hectares for management infrastructure.

The property has a water supply from a river, where a lake with a capacity of eight thousand liters will be built, to meet the needs of the cattle. For management infrastructure, a 150 mt/2 corral will be built with a vaccination trunk, an automated milking line associated with the troughs. With all the information obtained, the choice was to work with the jersey breed, this breed has good rusticity, has a much lower cost than the other dairy breeds because it eats less due to its size, wears out the pasture less due to its weight, has a good average milk production that is around 16 lt/day, It is an extremely docile breed, easy to deal with, with early reproduction as soon as the heifer can give birth at approximately one and a half years old.

Milk can be marketed separately for cheese production, as it contains high levels of solid materials, which results in savings and productivity in the cheese industry.

The location of the property is in the region of Pouso Alegre, where there are a large number of small properties.

Four heads per ha will be raised, the property will have five ha available for breeding, which will total twenty heads, which will also receive silage along with concentrate to meet their nutritional needs.

GOAL 2



Annual overdressing.

GENETIC IMPROVEMENT

Initially, 10 heifers aged between 2 and 3 years will be purchased in March, when heat is already scheduled for all of them according to the seller. The city of Pouso Alegre has the "Genetic Improvement Program of the city hall (PROGEN), this program benefits small producers, and the farm has already scheduled the insemination of heifers for March. 25 doses of semen from a Jersey bull, available through the program, are planned for the property. As the gestation will last 9 months, in December we will have our calves.

In March 2022, we will have the arrival of the other 10 heifers in heat, which will also be inseminated.

NUTRITION

In October 2020, *Panicum maximum* cv. Mombasa in 1.5 hectares of the property, as its adoption has taken place especially in milk production areas. In conditions of good fertility, which is the case of the 5 hectares, its production will start around 120 days, that is, in February, we will have pasture for these heifers. In the dry months, as the pasture decreases, the feed offered should contain a greater amount of protein and a lower amount of energy. The silage offered in the dry season also contains a low amount of protein. In the rainy months, we have improved pasture, that is, increased protein, so the feed offered should contain less protein and a greater amount of energy.

In the remaining three hectares, corn will be planted. Corn crop and off-season specific for silage, where we will have six hectares planted in the year. With these two productions per year, we will have silage for the initial herd of 10 heifers and already stock for the other 10 that will arrive in March 2022.

HANDLING

We will have 0.5 hectares for the installation of milking machines, troughs, a place for vaccination, insemination and medication, calves, shade places for the animals to rest, a 600-liter refrigerated tank for storing the milk that will be collected by the dairy every 2 days, places where the water will be supplied with quality and always fresh.

Vaccination against Foot-and-Mouth Disease and Rabies will be applied 1 time a year. Vaccination against Brucellosis will be applied to calves that will be born before 1 year of age. The sows will already be purchased vaccinated. Deworming will occur 2 times a



year, following the active ingredient of the medication recommended by the veterinarian, who will assist.

The dehorning procedure will be done, three and four weeks old, when the horn is a little protruding. This is a quick procedure that solves several problems associated with handling. The pain caused by the practice is significant and causes several damages to the development of the animal. Practices to reduce pain, such as the use of anesthetics, analgesics, and anti-inflammatories, should be adopted in order to ensure the well-being of calves and maintain animal performance.

Male cubs will be put up for sale, while females will grow up to become breeders. The milking place will always be cleaned, as well as the other feeding and resting points for the animals. An underground manure mill will be used, where solid waste will be deposited, built 50 meters from the stable to avoid disturbances with the proliferation of flies and bad smell. In manure, the fermentation of manure takes place around 60 to 90 days, depending on the average temperature of the region. It favors the death of worm larvae and produces a quality, safe, and easy-to-use fertilizer for pastures.

GOAL 3

Formulation of diets by categories.

CALVES

At birth, the calf is a monogastric calf with a stomach presenting different characteristics from the adult ruminant, not being able to use solid food, has a reflex to breastfeed, and has all the physiological and biochemical conditions to use milk. Under normal feeding and management conditions, in sixty to ninety days, this calf transforms into a ruminant with the ability to survive on roughage and concentrated feed, with the rumen-reticulum showing relevant microbial activity, development of papillae in its walls, and capacity for nutrient absorption by the walls of the rumen-reticulum.

Roughage foods are very important for the physiological development, size, and musculature of the rumen, especially for the last two (MAGALHÃES, 2001). A good roughage, hay or chopped green, should be provided from the second week of age.

HEIFERS

The rearing phase begins after weaning and extends to the first mating. It is less complex than the breeding phase, but requires a lot of attention from the producer, as the requirements of the growing animal are constantly changing, due to changes in the



composition of its body. Supply of concentrate to heifers is dependent on age, the quality of the roughage used, and the feeding plan adopted. In general, for six months, it is necessary to supply 1 to 2 kg of concentrate with 12% crude protein and 61% total digestible nutrients.

LACTATING COWS

Good quality roughage should be provided with supplementation with concentrates and an adequate mineral mixture. Cows with high production potential should have a dry matter intake equivalent to at least 4% of their live weight at peak intake. A complete diet is a mixture of roughage (silage, hay, chopped green grass) with concentrates (energy and protein), minerals, and vitamins.

The concentrate/roughage ratio is higher for cows with higher milk production. In a more generalized way, the concentrate/roughage ratios are suggested in the table below.

Production of Roughage Concentrate			
Milk (kg/day) % %			
Up to 14 30-35 65-70			
14 to 23 40 60			
24 to 35 45 55			
36 to 45 50-55 45-50			
Over 45 55-60 40-45			

PLANTING AREA

As the planting area has already been predefined, which in this case will be at the beginning of 1.5 ha of mombaça grass, which was chosen because it is an early variety and can withstand the trampling of the herd well.

EVOLUTION OF THE HERD

In the evolution of the herd, both the production and the conditions of its animals must be monitored and recorded, such as: herd sizing, animal category, cow progress, and zootechnical index.

HERD SIZING

The size of your herd and the area available for its feeding must be established, aiming at the quality of the grass and ensuring that it is sufficient to support the milk capacity of your animal.

CATEGORIES OF ANIMALS



It is necessary to have a relationship, properly divided into groups of animals. For example, lactating cows, dry cows, calves from 0 to 1 year old, heifers, bulls, etc.

PROGRESS OF THE COWS

Monitor the evolution of your animals according to the previously established zootechnical indexes, as well as the situation of these animals in the cases of purchase and sale, in order to be able to make decisions to increase or reduce your herd in order to make it more profitable.

ZOOTECHNICAL INDICES

This aspect is one of the essentials for the evolution of your herd. The indexes directly influence the number of cows in the herd as well as their production. In these indices, the rates of birth, mortality, retirement, and bull/cow ratio, for example, are analyzed (LOPES et al., 2000).

REPRODUCTION

Our reproduction will only be aimed at calves, since the property will have income only from the milk sold obtained from the cows, so calves that are calved will be sold and will not stay on the property.

Reproduction is the determining factor of milk production, and the production of each animal depends on its ability to get pregnant. Frustrations with reproductive inefficiency are not rare and represent one of the factors that most influence the economic success of dairy farming. The earlier the cow is pregnant, the better the kg of milk produced/day ratio of calving interval, an important parameter to evaluate the efficiency of the production system of each property.

Reproductive traits generally have low heritability. As a consequence, the response to selection is slow. Improvement in these indices can be obtained more quickly by improving environmental conditions.

The lower the IPP, the faster the animal will leave the rearing phase, producing more milk in its useful life in the herd.

FACILITIES AND BUILDINGS

It will have half a hectare on the property for the installation of milking machines, troughs, a vaccination trunk, space for insemination, shade places for the animals to rest,



and room for a 600-liter refrigerated tank to store milk until it is collected. Which will be collected every 2 days.

At first, 2 sets of milking machines were acquired, where it has a combined capacity of 300 liters of milk per day, which at first will be enough, since the milking site supports up to 6 sets in the production line. Our property will also have a manure mill to deposit solid manure, so letting fermentation can happen, we will use this fertilizer that will be of good quality and somewhat cheap, which we will use to fertilize the pastures.

Environmental

An unsustainable milk production system causes numerous environmental problems, such as erosion and local and global warming, directly affecting the means of production. According to what was said, milk production on the property will be organic production, where milk production increases without degrading natural reserves, increasing the possibility of gain for both the producer and society.

CONCLUSION

Although fictitious, this project can be implemented since: the chosen breed is low cost; Facilities are simple and low cost; most of the food will be produced on the property itself; milk is an easy product to market; and finally, the total cost of the project is low.



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