PRODUCTIVE REALITY AND POSSIBILITY OF USING CULTIVARS OF THE GENUS *MEGATHYRSUS*

https://doi.org/10.56238/sevened2024.032-004

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ABSTRACT

Inadequate pasture management in Brazil has resulted in degradation and reduced livestock productivity. Disordered intensive grazing compromises the response capacity of forages, while the lack of soil correction and fertilization, together with inadequate practices, contribute to low productivity and degradation of the environment. Erosion, especially laminar erosion, is a significant indicator of this problem, causing soil loss and increasing runoff. In addition, poor practices promote the emergence of weeds, aggravating the situation. It is crucial to adopt sustainable management technologies, such as pasture reform and recovery, to maintain their productive capacity. The choice of suitable forages and specific management are essential to ensure the sustainability of the animal production system. Cultivars of the genus Megathyrsus maximus are highlighted for their high dry matter production and nutritional quality. Since the 1980s, several cultivars have been developed in Brazil, starting with the Colonião cultivar, one of the first, and also others such as Tanzania-1, Mombasa, Massai, BRS Zuri, BRS Tamani and BRS Kenya, more current. The productive capacity of the forage canopy is influenced by factors such as temperature, light and nutrients, which must be respected for good production and persistence of pastures. Proper management, with grazing strategies, is necessary to optimize production and efficiency in pasture use.

Keywords: Forage. Pasture management. Intensive systems.

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INTRODUCTION

The use of pastures is essential for livestock in Brazil, as they predominate as the main source of food for cattle raising (MATOS et al., 2021), but inadequate soil and forage management has caused a drop in productivity and degradation.

The degradation of pastures directly affects productivity and raises livestock costs, as it requires greater feed supplementation to maintain the performance of herds. In addition, the loss of soil quality intensifies erosion and increases vulnerability to adverse weather conditions, compromising the profitability and sustainability of the sector (OLIVEIRA; MONTEBELLO, 2014).

Faced with this reality, the development of technologies aimed at pastures has made it possible to change this scenario. However, for this transformation to occur effectively, it is necessary to constantly carry out research that seeks to expand knowledge about the behavior and responses of forages to environmental factors, as well as aspects related to their use and management (FREITAS et al., 2016; ABREU et al., 2017).

As a response to the need for more efficient plants, the launch of new forage cultivars aims to meet the demand of the sector. In this sense, studies that evaluate genotypes can contribute to the improvement of these characteristics, in addition to promoting the diversification of pastures and reducing the impact of monoculture (MAIA et al., 2021).

In addition, the adoption of appropriate management practices emerges as one of the alternatives to mitigate the effects of seasonality in forage production. It is observed that the growth stage at which the plant is harvested directly influences the yield, chemical composition, regrowth capacity, and persistence of the crop (MATOS et al., 2021). In general, less frequent cuts or grazing provide greater forage production, but markedly reduce its nutritional quality (SOUZA et al., 2020). Thus, it is essential to seek a balance between forage production and quality, in order to meet the nutritional needs of the animals and, at the same time, ensure the persistence and productivity of pastures (MAIA et al., 2021).

The analysis of forage plant growth, therefore, offers important subsidies to evaluate the growth potential of cultivars, their responses to environmental variations and grazing management. This analysis also allows inferences about the physiological processes involved in plant responses to various stimuli (ABREU et al., 2017).

Finally, to establish effective strategies for the use of these grasses, it is essential to know the growth pattern, the production of forage plants and their behavior in the face of different managements, enabling a more efficient use and assertive recommendations for the sector.

DEVELOPMENT

PASTURES IN BRAZIL

In Brazil, pastures are the main source of food for cattle, supported by favorable climatic conditions and large areas of arable land. However, soils that are often acidic and have low fertility require specific management and a careful choice of forages to maintain productivity. These strategies not only meet the demand for animal protein, but also strengthen the livestock economy and ensure the sustainability of production systems (SISTE et al., 2023).

Regarding the territory, Brazil has a wide extension and a favorable climate, which allows large areas of pastures, which occupy approximately 50% of the country's rural establishments (CORDEIRO et al., 2015). However, despite this large area destined for pasture, about 130 million hectares are degraded or in the process of degradation, requiring urgent interventions.

In addition, although pastures represent the main and most accessible source of feed for livestock, they are influenced by the weather, especially during drought, which reduces forage production and quality. In the rainy season, pasture degradation is mainly caused by management failures, which is one of the factors that most limit forage production (SANTOS et al., 2021).

Given this situation, it is essential that pastures maintain productivity, which occurs with the continuity of leaf and tiller emission, a fundamental process for the restoration of leaf area after cutting or grazing. This emission ensures the longevity of the forage and its photosynthetic capacity, crucial for the development and growth of the plant (SARAIVA et al., 2019).

However, when the objective is to intensify animal production via intensive grazing, the regeneration capacity of plant tissues is affected by the constant removal of leaf area, compromising light absorption and, consequently, reducing pasture productivity (ANJOS et al., 2020).

Thus, it can be seen that the main problems of pasture productivity lie in the lack of soil correction and maintenance fertilization, added to the inadequate management of forages, such as disrespect for the correct periods of grazing and resting. The adoption of pasture management technologies, including reforms and fertilization, becomes essential to avoid a sharp drop in the carrying capacity, plant production and weight gain of the animals (FACTORI et al., 2017).

CHALLENGES AND OBSTACLES OF PASTURE PRODUCTION FOR LIVESTOCK

One of the main challenges in pasture production in Brazil is the adoption of efficient management practices, which are essential to sustain the growing demand for animal protein. Despite the country standing out as one of the largest meat exporters and having significant projections of increased production in the coming years, pastures still face critical problems. In this context, the high global demand positions Brazil as a potential supplier, benefiting from factors such as the wide availability of land and favorable climatic conditions. However, many pasture areas remain degraded due to inadequate management, resulting in serious socio-environmental and economic impacts. Thus, the low productivity and sustainability of livestock become significant obstacles for the sector (CORDEIRO et al., 2015).

These problems are closely associated with inefficient or neglected management practices, which include weed control, inadequate fertilization, mowing, fallow of animals, unplanned paddocks, excessive volume of animals, as well as plowing and harrowing in sloping areas, among other factors. The influence of regional physiographic conditions cannot be underestimated either (SARAIVA et al., 2019).

In addition, Kill-Silveira et al. (2020) address the complexity of proper pasture management, highlighting that this process is influenced by climatic variations throughout the year, different types of soil with different physical and chemical characteristics, and the grazing categories and habits of animal species. Another critical point is the introduction of grass cultivars, which often occurs without proper studies on the behavior of these species and their practical applications, which can make it difficult for managers to understand. The lack of technical assistance represents another challenge, as this support is crucial to increase production efficiency. Without this guidance, most producers remain in a position of mere exploitation of available resources, unable to implement significant improvements in animal production.

In this scenario, there is a growing pressure and restriction to the clearing of new areas for the establishment of pastures. This reality drives the search for management strategies and technologies that can provide the intensification of the production of cultivated pastures, generating economic gains and ensuring the sustainability of animal production systems (JACK et al., 2017).

This understanding leads to a critical point for increasing productivity: the planning and optimization of the use of production factors, such as water supply, temperature, photosynthetically active radiation, and nutrients. In addition, it is essential to choose the forage correctly and optimize the management factors, establishing appropriate goals for each grazing ecosystem. These actions aim to ensure the quantity and quality necessary for animal performance and productivity, ensuring the economic viability and sustainability of the production system (MATOS et al., 2021; FACTORI et al., 2017).

PASTURE USE SYSTEMS

Different management methods in pastures can be presented in two systems: continuous and rotational, as highlighted in Chart 1. There are a variety of opinions about what would be the best system to use, but these opinions are many and divergent. Studies have shown a significant effect of grazing pressure on animal performance and the performance of plant varieties. A common element in these experiments has been the interaction between stocking rate, grazing system, and the performance of forage varieties (MACHADO et al., 2019).

Table 1: Comparison of Advantages and Disadvantages between Continuous and Rotational Grazing Systems

	Continuous	Rotational
Advantages	Simplicity in management; Possibility of using native pastures; Ease of installation; Lower demand for labor; Lower costs and investment in more advanced technologies; Reduced stress for animals (VIERIA, 1997; JUNIOR; NETO, 2001; COSTA, 2007)	Improvements in weight gain and feed efficiency; Better control of pathogens and parasites, contributing to the health of animals; Higher stocking rate per area; High-quality, nutrient-rich forage; Improvements in pasture quality; Stimulating the growth of a variety of plant species, including grasses and legumes; More nutritionally balanced feed for the ruminant, with a positive impact on meat quality; Maintenance of soil health; Reduction of soil compaction and erosion; Enrichment of the soil in nutrients by the deposition of animal manure; Reduction in the need for chemical fertilization; Reduction of the environmental impact of livestock; Preservation of natural resources and avoidance of water contamination; (SHIBU; DOLLINGER, 2019; FUKUMOTO et al., 2010).

Disadvantages	Low rate of weight gain and feed efficiency; Less control over capacity capacity; Impact on forage growth and regeneration; Greater compaction and wear of the soil; Increased susceptibility to pests and pathogens in pasture (COSTA, 2007; JUNIOR; NETO, 2001; JÚNIOR, 2002; VIEIRA, 1997).	It requires a detailed analysis of costs and investment of more advanced technologies; It requires better management and technical knowledge and continuous supervision; Failures in management can compromise results; Climatic variations and unpredictability of weather, such as prolonged droughts, which can affect the availability of forage; Requirement for food supplementation, increasing production costs; (SATO et al., 2014; ALEMU et al., 2019).

Combined with the genetic improvement of forage plants, the grazing system adopted can be fundamental for the improvement of the production process. The continuous system is the most used, as it requires lower expenses for its installation, requiring only the implementation of fences, water supply and troughs (FLORINDO et al., 2017).

However, even with all the favorable conditions in Brazil, several localities do not take adequate advantage of these conditions, due to the low efficiency of grazing management. The choice of the type of grazing system is based on the simplicity and advantages of the operations performed, especially in maintaining pasture productivity (MATOS et al., 2021).

In the continuous system, the animals remain extensively in the pasture throughout the year, requiring the use of a perennial cycle pasture. The category of animal (cow, calf, etc.) must be adjusted according to the production capacity of the forage; thus, lighter categories should be allocated to areas of lower production or the adjustment of lower capacity should be made for heavier categories (SILVA et al., 2016).

This system requires a smaller volume of labor, since it is not necessary to alternate the area for the crowded animals. However, a problem that prevails in this system is the pressure of animals on the forage, which hinders the revitalization of the plant, delays regrowth, and increases the amount of damaged plants (LIMA et al., 2018).

On the other hand, the rotational grazing system is characterized by the periodic and frequent exchange of animals from one paddock to another, with the objective of offering a rest time for the forages. This system allows for better results, since forage management is carried out intensively, providing greater availability of quality forage (BISI et al., 2019).

After the occupation of each paddock, for a variable period of time of a few days, when its vegetation is totally or partially defoliated, the paddock remains at rest, without the presence of animals, allowing the recovery of its foliage and completing the grazing cycle (MACHADO et al., 2019).

MAIN FORAGES USED

In Brazil, cattle production, for the most part, uses two genera of pastures: *Urochloa* and *Megathyrsus*, tropical grasses with high production potential, both in quantity and quality. However, this potential has not been explored due to inadequate management and the lack of nutrient replacement in the system, especially nitrogen (N), causing a decline in production and ultimately harming animal production (SILVA et al., 2016).

As in other economic activities, the production of pastures undergoes constant evolution. In this sense, the choice of variety or the recovery of pastures becomes a necessary procedure for the establishment or maintenance of high productivity (ABREU et al., 2017).

The species *Megathyrsus maximus* Jacq. is one of the main forages cultivated worldwide in tropical and subtropical regions. In Brazil, it is highly valued for its high dry matter production capacity, forage quality, ease of establishment and acceptability by animals (ABREU et al., 2017).

In the 80s, when the work of genetic improvement of *M.* maximus grass began, the interest of technicians and cattle breeders in this species resurfaced. Allied to the novelty also came a greater awareness of the importance of pasture management and soil fertility for these pastures to be maintained (GARCEZ et al., 2020).

The first cultivar of *M. maximus* used in Brazil was cv. Colonião and since the beginning of the breeding program in *M. maximus* , the cultivars launched by Embrapa Beef Cattle so far have been: Tanzania-1 (in 1990), Mombasa (in 1993), Massai (in 2000), BRS Zuri (in 2014), BRS Tamani (in 2015), as the first hybrid cultivar of *M. maximus* developed by EMBRAPA, and more recently, in 2017, BRS Kenya (JANK et al., 2017a).

Within this context, the Tanzania cultivar, originally from Tanzania, Africa, is a variety of *M. maximus* that was released for commercialization by Embrapa in 1990 due to its high annual production and excellent nutritional value. Its development aimed to replace Colonião grass, standing out for producing up to 80% more leaf mass, 6% more growth in the dry season and 32% more seeds. Its smaller size and abundance of leaves favor a more uniform grazing, minimizing the mosaic effect typical of the Colonião and Mombaça cultivars, as reported by Jank et al. (2017a) and Embrapa (2013).

Tanzania grass is medium-sized, growing around 1.30 m, with a cespitose shape and clumps. Its leaves are decumbent, free of hairiness and waxiness, and flowering is concentrated in April in the southeast and central-west regions. Dry matter data show significant yields of 27.80 t $^{ha-1}$ with irrigation and 24.43 t ha-1 without irrigation, while crude protein reaches 16.2% in leaves and 9.8% in stems. Compared to Mombaça grass, the

Tanzania cultivar has a superior performance, with protein levels of 13.91% compared to 11.55% (LIMA, 2009). Tanzania grass is well adapted for silage due to the high production of forage, but it is not ideal for haying due to the thicker and juicier culms, which make the process difficult (GOMIDE et al., 2016).

Adapted to soils of medium to high fertility, Tanzania has good tolerance to poorly drained soils and resistance to grassland leafhoppers, although it is susceptible to the fungus *Bipolaris maydis*. The presence of stems during flowering can reduce the nutritive value of the pasture and make it difficult for the animal to harvest, but these effects can be minimized with proper management practices. Its use has expanded among producers in integrated crop-livestock systems, replacing elephant grass and *U. decumbens* in degraded areas (SANTOS; COSTA, 2006).

One of the biggest challenges that Tanzania grass has is its susceptibility to leaf spot. This fungal disease causes dark spots on leaves, compromising photosynthesis and reducing pasture productivity. Over time, this problem has led many growers to replace Tanzania with other, more resistant varieties, as controlling the disease can be difficult and costly, especially in regions with high humidity, where the fungus proliferates more easily. Today, Tanzania grass has lost ground precisely because of the difficulty of maintaining healthy and productive pastures in the face of this threat (MARTINEZ et al., 2010; MARCOS et al., 2015).

In addition to susceptibility to leaf spot, another important obstacle in the use of Tanzania grass is the difficulty in obtaining its seeds. The production of seeds of this variety is complex, requiring specific conditions to ensure viability and adequate germination, which often results in low supply in the market and high prices. This further discourages producers, who are looking for more affordable and resistant alternatives. Thus, problems with the disease and the limitation of seeds have made Tanzania an increasingly less viable option in production systems that seek sustainability and efficiency (TOMAZ et al., 2010; GOMES et al., 2008)

The Mombaça cultivar, originally from Tanzania and selected by Embrapa Beef Cattle in collaboration with the Agronomic Institute of Paraná, was commercially launched in 1993. This cultivar stood out for its high productivity and low seasonality index, presenting up to 28% more weight gain per area than the cultivar Tanzania-1. Mombaça grass is valued among cattle breeders for its long leaves, tall size and high acceptance by animals, forming clumps up to 1.65 m in height, purplish stalks and slightly hairy leaves on the upper face. Although it requires soils of medium to high fertility for good establishment, its wide adaptation and nutritional value make it an attractive choice for forage production (JANK, 1995; FONSECA et al., 2010; JANK et al., 2010; LEMPP et al., 2001).

With dry matter yields between 15 and 20 t $^{ha-1}$ and crude protein contents between 10 and 12% throughout the year, Mombasa maintains about 82% of leaves in the composition and is well accepted by cattle, buffaloes, sheep and goats. Its high capacity to use available phosphorus (P) and moderate resistance to grassland leafhoppers make it superior to other cultivars. In addition, the high production of dry biomass in Mombasa has encouraged its potential use for silage, favoring production systems that seek greater food security and versatility in forage management (CERQUEIRA, 2010; EUCLIDES et al., 2008).

Another highlight is the Massai grass, which is a low-sized grass, with clumps up to 60 cm in height and narrow, brittle leaves, with an average width of 9 mm. Very versatile, it can be used both in extensive, intensive and rotational grazing as well as for cutting and haying. Its leaf production reaches 15.6 t ha^{-1} of dry matter, a number comparable to that of colonião grass, but with less seasonality, that is, it maintains production throughout the year in a more uniform way. In nutritional terms, Massai grass offers 12.5% of crude protein in the leaves and 8.5% in the stems, values similar to those of the Tanzania cultivar, making it an attractive option for animal nutrition in different regions of Brazil (LEMPP et al., 2001).

The adaptability of Massai grass was extensively tested by Embrapa Beef Cattle, showing its ability to develop in various soil types (pH 4.9 to 6.8), latitudes between 3° and 23°5', altitudes from 100 to 1,007 meters and annual rainfall between 1,040 and 1,865 mm. In the northeastern semiarid region, the cultivar proved to be productive and versatile, being studied in systems with different N levels, where up to 934 kg of N per hectare per year generated good results without affecting plant morphology. In addition, its good tolerance to shaded areas and adaptation to silvopastoral systems make Massai grass an excellent alternative to enrich areas of the Caatinga, improving forage production and contributing to the feeding of sheep and other ruminants in challenging environments (LOPES, 2012; CARVALHO et al., 2014; ARAÚJO, 2015).

Two decades after the launch of the Tanzania-1 and Mombaça cultivars, Embrapa Beef Cattle, in partnership with Unipasto, launched the BRS Zuri cultivar in 2014. This new forage was developed from populations of *M. maximus* collected in Tanzania, East Africa, and underwent rigorous tests in the different Brazilian biomes. BRS Zuri stands out for its high productivity, regrowth vigor, carrying capacity, and good animal performance. In addition, it is resistant to grasshoppers and leaf spot caused by the fungus *Bipolaris maydis*, a common problem in the Tanzania-1 cultivar. Adapted to well-drained soils of medium to high fertility, this cultivar shows a significant accumulation of forage and leaves, surpassing the Mombasa in some aspects. Its leaves are wide, long and arched, with a dark green color, characterizing a tall cespitosa plant (EMBRAPA, 2014).

In tests carried out by Embrapa, BRS Zuri showed a production of 21.8 t $^{ha-1}$ of leaf dry matter under manual cutting, with approximately 85% of this yield concentrated in the rainy season, which makes management in a rotational stocking system the most indicated. In terms of nutritional value, the cultivar showed a crude protein content between 11% and 15% in the leaves and from 7% to 12% in the stems. In comparative studies on the response to P, BRS Zuri stood out with an average yield of 6,694 kg $^{ha-1}$ of total dry matter, higher than that of BRS Kenya, in addition to presenting a leaf proportion of 65.7%, an index also higher than that of Mombaça and BRS Kenya grasses, with 62.6% and 63.0%, respectively (JANK et al., 2017b).

BRS Tamani is the first hybrid grass cultivar developed by Embrapa Beef Cattle in collaboration with several Embrapa units, such as Embrapa Acre, Cerrados, Dairy Cattle, Southern Livestock and Rondônia. Resulting from the cross between a sexual plant (S12) and an apomictic access (T60 - BRA-007234) (EMBRAPA, 2015).

With a short size and cespitous growth, the Tamani cultivar reaches up to 1.3 meters, with long, thin and arched leaves that reach 1.09 cm in length, in addition to being rich in crude protein and highly digestible. In cutting trials, the dry matter yield reached 15 t $^{ha-1\ year-1}$. In the dry periods, Tamani has a crude protein content of 10% and digestibility of 60%, while in the waters, these values rise to 12.4% of crude protein and 59.6% of digestibility. The cultivar is indicated for the Cerrado and for the Amazon and Atlantic Forest biomes, as long as they are in well-drained soils and of medium to high fertility. Despite its good resistance to pests, Tamani does not tolerate waterlogged soils, preferring areas with good structure and, ideally, previously cultivated soil. In terms of resistance, Tamani has similar tolerance to *M. maximus* cultivars, such as Massai, Mombasa and Tanzania (EMBRAPA, 2015; MACIEL et al., 2018)

Another BRS Kenya cultivar, launched by Embrapa Beef Cattle in 2017 in partnership with Unipasto, is an intermediate-sized hybrid of *M. maximus*, bred to meet the demand for a forage of high productivity and quality, in addition to easy management due to its smaller size and reduced stalk elongation. Its characteristics include soft leaves, tender culms, and high tillering capacity, which facilitates management, especially in rotational systems. In the Cerrado and the Amazon, this cultivar blooms between January and February, with continuous tillering that extends the grazing period until May or June, according to rainfall. Another differential is the resistance to the grasshopper by antibiosis, a factor that contributes to the longevity and quality of the forage (EMBRAPA, 2017; JANK et al., 2017a).

BRS Kenya offers good yields, with an average production of 13.2 t $^{ha-1}$ of dry matter in the waters and 1.41 t $^{ha-1}$ in the dry season, surpassing the Tanzania and Mombasa cultivars. In terms of quality, crude protein reaches 10.6% in drought and 11.8% in water, values higher than those of Tanzania and Mombasa, while neutral detergent fiber (NDF) remains between 72% and 75%, a lower rate than that of the other cultivars. However, it is important to note that BRS Kenya is not suitable for waterlogged soils, as its performance is compromised in areas with drainage problems. For optimal management, Embrapa suggests the entry of the animals into the paddocks when the forage reaches between 70 and 75 cm and the removal around 35 to 40 cm. Although there are no specific guidelines for silage production, the potential for use is promising, given the quality of the biomass of this cultivar (EMBRAPA, 2017; JANK et al., 2017a).

In a general context, grasses of the genus *Megathyrsus* maintain their productivity levels with adequate nutrient replacement, through maintenance fertilization. Adequate soil management, fertilization, and knowledge about the nutritional needs of plants are fundamental factors, as they interfere with pasture productivity and quality (JANK et al., 2017a).

Irrigation enables greater forage mass production in *M. maximus* grass cultivars. Irrigation makes possible a better balance in DM productivity between autumn/winter and spring/summer. By associating adequate temperature and radiation with the necessary water availability and high fertilization rates, especially nitrogen fertilization, the recovery of the pasture occurs faster and it is possible to obtain pastures with excellent nutritional value (CARDOSO et al., 2017).

Regarding pasture management, in situations of reduced defoliation intensity, losses may occur, as a higher senescence index of a material that can be consumed by animals will be observed. The results demonstrate the importance that the structure of the forage canopy has on the accumulation and nutritional value of the forage produced and on the ingestive behavior, intake and performance of grazing animals. Thus, the development of management strategies based on grazing heights becomes a viable option aiming at the efficiency in the productivity of systems in pastures in tropical areas (SBRISSIA et al., 2017).

The monitoring and control of canopy height contribute to the selection of management strategies, and enable the understanding of very significant relationships regarding the responses of the forage plant and the animals. In this way, it becomes possible to understand the effects of canopy structural variations related to production, plant persistence and animal performance. Different forage plants are able to change the composition of the canopy in response to the defoliation regime. It is also noteworthy that the search and seizure of forage by grazing animals are influenced by the spatial and structural arrangement of the canopy (ANJOS et al., 2020).

The growth stage at which the plant is harvested directly affects yield, chemical composition, regrowth capacity and persistence (COSTA et al., 2012). In general, less frequent cuts or grazing provide higher forage production, however, at the same time, there are sharp decreases in its chemical composition (GOMIDE; GOMIDE, 2000; COSTA et al., 2003). Therefore, a balance between forage production and quality should be sought, in order to ensure the nutritional requirements of the animals and simultaneously ensuring the persistence and productivity of pastures (COSTA et al., 2004). Evaluating the effects of plant age on forage yield, regrowth vigor and growth parameters of *M. maximus* cv. Centenário Costa et al. (2013) found that the age of regrowth affects forage yield, growth rates, leaf expansion and leaf area index of the grass.

In a study with four grass cultivars of the genus *Megathyrsus* at two cutting intervals, Santos (2022) found that the cultivars Zuri and Mombaça stood out when managed with an interval between cuts of 21 days, because in this regime they had high production of dry mass, that is, they generated more biomass (Table 1). In addition, they exhibited robust vegetative growth, with taller and wider leaves, indicating good plant development.

Table 1: Accumulated productivity (kg of DM ha^{-1} $year^{-1}$) in the second cycle and average height of grass of four cultivars of *Megathyrsus grass.*

Cultivate	Productivity (kg $^{ha-1}$)		Height (cm)	
	21 days	28 days	21 days	28 days
Tamani	11.022	11.469	49,4	53,4
Kenya	11.157	10.486	64,7	70,4
Zuri	14.645	12.062	75,9	80,7
Mombasa	14.850	12.951	77,8	82,6

Source: Santos (2022)

Also according to the same author, the Tamani cultivar stood out for the production of many tillers, being recommended for those who want a higher density of plants in the field, which can increase soil cover. The Kenya cultivar benefited from a longer cutting interval of 28 days, showing good adaptation to less frequent management and maintaining a satisfactory productivity, which makes it suitable for management systems with more spaced cuts. At 21 days, this cultivar did not reach the entry height suggested by Embrapa, which is 70 and 75 cm (EMBRAPA, 2017).

FINAL CONSIDERATIONS

So the importance of management is noted, because when not carried out correctly, it generates degradation and a drop in livestock productivity, with problems. Therefore, the adoption of sustainable practices, such as choosing suitable forages and soil correction, is essential to reverse this scenario. Cultivars such as those of the genus *M. maximus* stand out for their high production and nutritional quality, being alternatives for the recovery and maintenance of pasture productivity. Proper management is vital to ensure the sustainability and efficiency of the animal production system.

In view of this, the studies indicate that the management of cuts should be adjusted according to each cultivar and the production objectives, considering the different responses in terms of productivity and morphological development of the plant.

REFERENCES

1. Abreu, A. M. A., Santos, G., Guimarães, B. V. C., Da Silva, J., & Guimarães, G. C. (2017). Panorama socioeconômico da pecuária leiteira no município de Pindaí/BA Semiárido Baiano. *Enciclopédia Biosfera, 14*(25), 402.

2. Alemu, A. W., Krobel, R., McConkey, B. G., & Iwaasa, A. D. (2019). Effect of increasing species diversity and grazing management on pasture productivity, animal performance, and soil carbon sequestration of re-established pasture in Canadian Prairie. *Animals (Basel), 9*(4), 127-136.

3. Anjos, A. J., Freitas, C. A. S., Coutinho, D. N., Silva, B. C. M., Sena, H. P., Soares, B. B., Pires, C. P., & De Freitas, R. L. (2020). Estratégias de manejo do pastejo para produção intensiva de leite em pastos tropicais. *PUBVET, 14*(11), 1-12.

4. Araújo, A. R. (2015). *Composição botânica e qualidade do pasto selecionado por ovelhas em caatinga raleada e enriquecida* (Tese de Doutorado). Escola de Veterinária da Universidade Federal de Minas Gerais – UFMG, Belo Horizonte, Minas Gerais.

5. Bisi, B. S., Bonini, B. S. B., Neto, A. B., Heinrichs, R., Meirelles, B. C., Oliverio, G. L., & Mateus, G. P. (2019). Pasture recovery using Stylosanthes cv. Campo Grande: Effect on soil quality. *Revista Brasileira de Ciências Agrárias, 14*(4), e6697.

6. Cardoso, J. C. Q., Tomaz, R. S., & Lima, R. S. (2017). Produtividade de massa seca e atributos físico-químicos da forrageira capim mombaça (Panicum maximum) submetido a diferentes lâminas de irrigação e doses de nitrogênio. *ANAP Brasil, 10*(18), 51-65.

7. Carvalho, W. F., Moura, R. L., Santos, M. S., et al. (2014). Morfogênese e estrutura de capim-massai em diferentes sistemas de cultivo sob pastejo. *Revista Brasileira de Agropecuária Sustentável (RBAS), 4*(1), 28-37.

8. Cerqueira, V. D. (2010). *Cólica em equídeos mantidos em diferentes cultivares de Panicum maximum no bioma amazônico* (Tese de Doutorado). Biblioteca Digital de Teses e Dissertações da Universidade de São Paulo, São Paulo. DOI: 10.11606/T.10.2010.tde-24032011-112859. Disponível em: http://www.teses.usp.br/teses/disponiveis/10/10133/tde-24032011-112859/. Acesso em: 28 out. 2024.

9. Cordeiro, L. A. M., Vilela, L., Marchao, R. L., Kluthcouski, J., & Martha Junior, G. B. (2015). Integração lavoura-pecuária e integração lavoura-pecuária-floresta: Estratégias para intensificação sustentável do uso do solo. *Cadernos de Ciência & Tecnologia, 32*(1), 15-53.

10. Costa, N. L., Paulino, V. T., Magalhães, J. A., Townsend, C. R., & Pereira, R. G. A. (2013). Análise de crescimento de *Panicum maximum* cv. Centenário nos cerrados de Rondônia. *PUBVET, 7*(20), 1-11.

11. Costa, N. L., Gianluppi, V., & Moraes, A. (2012). Produtividade de forragem e morfogênese de *Trachypogon vestitus*, durante o período seco, em área de cerrado, Roraima. *Revista Trópica - Ciências Agrárias e Biológicas, 6*(1), 93-103.

12. Costa, N. D. L., Magalhães, J. A., Pereira, R. D. A., Townsend, C. R., & Oliveira, J. D. C. (2007). Considerações sobre o manejo de pastagens na Amazônia Ocidental.

13. Costa, N. L., Gonçalves, C. A., Oliveira, J. R. C., Oliveira, M. A. S., & Magalhães, J. A. (2004). Rendimento e qualidade da forragem de *Pennisetum purpureum* cv. Mott em diferentes idades de corte. Porto Velho: Embrapa Rondônia. 4 p. (Comunicado Técnico, 284).

14. Costa, N. L., Paulino, V. T., Townsend, C. R., Pereira, R. G. A., & Magalhães, J. A. (2003). Avaliação agronômica de genótipos de *Brachiaria* em Rondônia. Porto Velho: Embrapa Rondônia. 3 p. (Comunicado Técnico, 259).

15. Embrapa, Empresa Brasileira de Pesquisa Agropecuária. (2017). BRS Quênia. Campo Grande: Centro Nacional de Pesquisa de Gado de Corte.

16. Embrapa Gado de Corte. (2015). BRS Tamani, forrageira híbrida de *Panicum maximum*. Campo Grande, MS: Embrapa Gado de Corte. (Folder).

17. Embrapa, Empresa Brasileira de Pesquisa Agropecuária. (2014). BRS Zuri: Produção e resistência para a pecuária. Campo Grande: Centro Nacional de Pesquisa de Gado de Corte.

18. Embrapa Gado de Corte. (2013). Tanzânia-1 *Panicum maximum*. Campo Grande, MS: Embrapa Gado de Corte. (Folder).

19. Euclides, V. P. B., Macedo, M. C. M., Zimmer, A. H., Jank, L., & Oliveira, M. P. (2008). Avaliação dos capins mombaça e massai sob pastejo. *Revista Brasileira de Zootecnia, 37*(1), 18–26.

20. Factori, M. A., Silva, P. C. G., Gonçalves, D. M., Scatulin-Neto, A., Maratti, C. H. Z., & Tiritan, C. S. (2017). Produtividade de massa de forragem e proteína bruta do capim mombaça irrigado em função da adubação nitrogenada. *Colloquium Agrariae, 13*(3).

21. Florindo, J. B., Rosa, N. da S., Romualdo, L. M., da Silva, F. de F., Luz, P. H. de C., Herling, V. R., & Bruno, O. M. (2014). Identificação de espécies de *Brachiaria* usando técnicas de imagem baseadas em descritores fractais. *Computadores e Eletrônicos na Agricultura, 103*, 48–54.

22. Freitas, G. A., Bendito, B. P. C., Santos, A. C. M., & Sousa, P. A. (2016). Diagnóstico ambiental de áreas de pastagens degradadas no município de Gurupi-TO. *Biota Amazônia, 6*(1), 10–15.

23. Fonseca, D. M., Santos, M. E. R., & Martuscello, J. A. (2010). Importância das forrageiras no sistema de produção. In D. M. Fonseca & J. A. Martuscello (Orgs.), *Plantas forrageiras* (1ª ed., pp. 13–29). Viçosa: Editora UFV.

24. Fukumoto, N. M., Damasceno, J. C., Deresz, F., Martins, C. E., Cóser, A. C., & Santos, G. T. (2010). Produção e composição do leite, consumo de matéria seca e taxa de lotação em pastagens de gramíneas tropicais manejadas sob lotação rotacionada. *Revista Brasileira de Zootecnia, 39*(7), 1548–1557.

25. Garcez, B. S., Alves, A. A., Macedo, E. de O., Santos, C. M., Araújo, D. L. de C., & Lacerda, M. da S. B. (2020). Ruminal degradation of Panicum grasses in three post-

regrowth ages. *Ciência Animal Brasileira, 21*, e-55699. https://doi.org/10.1590/cab.v21.e55699

26. Gomes, D. P., Silva, G. C., Cavalcante, M. R., Silva, A., Cândido, C., Machado, K., & Rêgo, A. (2008). Qualidade de sementes de *Panicum maximum* cv. Tanzânia e *Brachiaria humidicola*. *Encontro Latino Americano de Iniciação Científica, 12*, 1–3.

27. Gomide, C. D. M., Paciullo, D., Leite, J., & Resende. (2016). *Panicum maximum* cvs. Tanzânia e Mombaça para uso em pastejo: produção e custo. Embrapa Gado de Leite. *Circular Técnica, 113*.

28. Gomide, C. A. M., & Gomide, J. A. (2000). Morfogênese de cultivares de *Panicum maximum* Jacq. *Revista Brasileira de Zootecnia, 29*(2), 341–348. https://doi.org/10.1590/S1516-35982000000200005

29. Jank, L., De Andrade, C. M. S., Barbosa, R. A., Macedo, M. C. M., Valério, J. R., Berzignassi, J., Zimmer, A. H., Fernandes, C. D., Santos, M. F., & Simeão, R. M. (2017a). O capim-BRS Quênia (*Panicum maximum* Jacq.) na diversificação e intensificação das pastagens. *Embrapa, Comunicado Técnico, 138*.

30. Jank, L., Santos, M. F., Borges, C. V., Carvalho, S. B., & Simeão, R. (2017b). Novas alternativas de cultivares de forrageiras e melhoramento para a sustentabilidade da pecuária. In *Anais do Simpósio de Produção Animal a Pasto*.

31. Jank, L. (1995). Melhoramento e seleção de variedades de *Panicum maximum*. In *Anais do 12º Simpósio Sobre Manejo da Pastagem* (pp. 21–58).

32. Jank, L., Martuscello, J. A., Euclides, V. P. B., Valle, C. B., & Resende, R. M. S. (2010). *Panicum maximum*. In D. M. Fonseca & J. A. Martuscello (Eds.), *Plantas Forrageiras* (1st ed., pp. 166–196). Viçosa: Editora UFV.

33. Júnior, D. N., & Neto, F. A. G. (2001). *Complexidade e estabilidade de pastejo*. Viçosa: Universidade Federal de Viçosa.

34. Júnior, G. B. M. (2002). *Sistema de produção animal em pastejo: Um enfoque de negócio*. Embrapa Cerrados.

35. Kill-Silveira, R. (2020). Manejo ecofisiológico das gramíneas *Megathyrsus maximus* (*Panicum maximum*) cv. Tanzânia, Mombaça e Massai. *Veterinária e Zootecnia, 27*, 1–13.

36. Lempp, B., Souza, F. H. D., Costa, J. C. G., Bono, J. A. M., Valério, J. R., Jank, L., Macedo, M. C. M., Euclides, V. B. P., & Savidan, Y. H. (2001). *Capim-massai* (*Panicum maximum* cv. Massai): alternativa para diversificação de pastagens. *Comunicado Técnico, 69*. Campo Grande: Embrapa Gado de Corte.

37. Lima, G. S. A., Ferreira, N. C., & Ferreira, M. E. (2018). Modelagem de perda superficial de solo para cenários de agricultura e pastagem na região metropolitana de Goiânia. *Revista Brasileira de Cartografia, 70*(4), 1510–1536.

38. Lima, A. F. (2009). *Avaliação de clones de Panicum maximum Jacq. submetidos à suspensão hídrica* (Master’s dissertation). Universidade Federal Rural de Pernambuco.

39. Lopes, M. N. (2012). *Trocas gasosas e morfofisiologia em capim-massai sob pastejo e adubado com nitrogênio* (Dissertação de Mestrado). Universidade Federal do Ceará - UFC, Fortaleza, Ceará.

40. Maciel, G. A., Braga, G. J., Guimarães Jr., R., Ramos, A. K. B., Carvalho, M. A., Fernandes, F. D., Fonseca, C. E. L., & Jank, L. (2018). Seasonal liveweight gain of beef cattle on guineagrass pastures in the Brazilian Cerrados. *Agronomy Journal, 110.*

41. Machado, C. G., Cruz, S. C. S., Silva, G. Z., Carneiro, L. C., & Silva, I. M. H. de L. (2019). Harvesting methods on physical and physiological quality of *Panicum maximum* seeds. *Agriambi, 23*(4), 309-313.

42. Maia, L. S., Beber, P. M., Tavares, J. V. N., Souza, M. S. de, Santos, V. M. dos, & Santos, A. J. dos. (2021). Valor cultural de sementes de gramíneas forrageiras comercializadas no Acre. *Revista Conexão na Amazônia, 2*(2), 29-42.

43. Marcos, M. F., Jank, L., Fernandes, C. D., Verzignassi, J. R., Mallmann, G., Queiróz, C. A., & Batista, M. V. (2015). Reação à *Bipolaris maydis*, agente causal da mancha foliar, em híbridos apomíticos de *Panicum maximum*. *Summa Phytopathologica, 41*(3), 197–201.

44. Martinez, A. S., Franzener, G., & Stangarlin, J. R. (2010). Dano causado por *Bipolaris maydis* em *Panicum maximum* cv. Tanzânia-1. *Semina: Ciências Agrárias, 31*(4), 863-870.

45. Matos, L. V., Donato, S. L. R., Kondo, M. K., & Lani, J. L. (2021). Sistemas tradicionais de produção de palma forrageira 'Gigante' em agroecossistemas do Semiárido Baiano. *Revista Brasileira de Geografia Física, 14*(2), 554-590.

46. Oliveira, A. P. N., & Montebello, A. E. S. (2014). Aspectos econômicos e impactos ambientais da pecuária bovina de corte brasileira. *Revista Científica Centro Universitário de Araras "Dr. Edmundo Ulson, 9*(2).

47. Santos, G. S. (2022). *Avaliação e caracterização morfológica de cultivares de Megathyrsus maximus sob intervalos de corte* (Dissertação de Mestrado). Universidade Estadual de Goiás.

48. Santos, A. P. S., Pires, A. J. V., Fries, D. D., Dias, D. L. S., Bonomo, P., Jardim, R. R., Seixas, A. A., Rossa, F., Santos, C. P. S., Cruz, N. T., & Paiva, L. S. (2021). Pasture assessment methods: A brief review. *Research, Society and Development, 10*(16), e52101622864.

49. Santos, P. M., & Costa, R. Z. (2006). *Manejo de pastagens de capim-tanzânia*. Documentos Embrapa Pecuária Sudeste, n. 52.

50. Saraiva, V. I. C., Silva, A. S. da, & Santos, J. P. C. (2019). Suscetibilidade a erosão dos solos da bacia hidrográfica Lagos – São João, no estado do Rio de Janeiro – Brasil, a partir do método AHP e análise multicritério. *Revista Brasileira de Geografia Física, 12*(4), 1415-1430.

51. Sato, S. A. S., Aleixo, N. D., Aleixo, A. D., Loose, C. E., Burgarelli, W. R., & Quintino, S. M. (2024). Custos de produção e análise da viabilidade econômica da terminação de

novilhos da raça Aberdeen Angus em relação a Nelore, em pastagem semi-intensiva. *Anais do Congresso Brasileiro de Custos - ABC.* Disponível em: https://anaiscbc.emnuvens.com.br/anais/article/view/3750.

52. Sbrissia, A. S., Duchini, P. G., Echeverria, J. R., Miqueloto, T., Bernardon, A., & Américo, L. F. (2017). Produção animal em pastagens cultivadas em regiões de clima temperado da América Latina. *Archivos Latinoamericanos de Producción Animal, 25*(1), 47-60.

53. Shibu, J., & Dollinger, J. (2019). Silvopasture: A sustainable livestock production system. *Agroforestry Systems, 93*, 1-9.

54. Silva, J. L., Ribeiro, K. G., Herculano, B. N., Pereira, O. G., Pereira, R. C., & Soares, F. L. P. (2016). Massa de forragem e características estruturais e bromatológicas de cultivares de *Brachiaria* e *Panicum*. *Ciência Animal Brasileira, 17*(3), 342-348.

55. Siste, D. A. B., Bigardi, L. R., Matrângolo, W. J. R., Cardoso, I. M., Ramirez, M. A., & Lana, A. M. Q. (2023). Sistematização do redesenho das pastagens em áreas montanhosas nas unidades familiares em transição agroecológica. *Revista Delos, 16*(46), 2106–2126.

56. Souza, J. P., Townsend, C. R., Araújo, S. R. do C., & Oliveira, G. C. (2020). Características morfogênicas, estruturais e agronômicas de gramíneas tropicais: Uma revisão. *Research, Society and Development, 9*(8), e942986588.

57. Tomaz, C. D. A., Martins, C. C., Carvalho, L. R. D., & Nakagawa, J. (2010). Duração do teste de germinação do capim-tanzânia. *Revista Brasileira de Sementes, 32*, 80-87.

58. Vieira, M. J. (1997). *Uso intensivo de pastagens*. Embrapa Gado de Corte, Campo Grande - MS.