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Dynamics of Cutting Intervals in Elephant Grass

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Abstract— The objective of this work was to identify the best cutting season of elephant grass, the present investigation was carried out in Salinas cue district of Horqueta, department of Concepción, Paraguay. The experimental design used was completely random, with 4 treatments and 5 repetitions, the treatments consisted of different intervals of cut being T1: 70 days, T2: 60 days, T3: 50 days and T4: 40 days. The determinations evaluated were subjected to analysis of variance by means of the Fisher Test at 5% and subsequent regression analysis. The highest values for the height of the plant were given at 70 days after the cut reaching an average of 1.43 m, the determination of green matter increased quite a lot at 70 days with 8.012 Mg ha-1, with respect to Dry matter the highest result was found at 70 days with 0.4 Mg ha-1, for the value of the crude protein (PB) of the cut material a very high value was found at 60 days with 6.46% other cutting days are showing a decline until reaching 5.34%. The results obtained in this research show that elephant grass at 60 days in full plant has the best percentages of PB and 70 days of cuts has very high values in the other variables evaluated, therefore its use is recommended, since cattle can improve their productivity.

Keywords—Cutting; intervals; Pennisetum purpureum; protein.

1. INTRODUCTION

The need to increase the production of land available for agricultural activities, forces producers to resort to alternatives that provide volume but that in turn print quality for production, which is why they must implement pastures managed under a cutting and hauling regime, in order to meet the daily needs of the herds. One of the most used grass species is Pennisetum purpureum, which is characterized by having a good biomass production of acceptable nutritional quality [2;12].

The adequate management of this grass, involves aspects such as the age of regrowth, which is closely linked to the leaf / stem relationship that presents the material offered to the animals [4] and that will largely define the use that can be made of the available material; At the same time, this variable can help to identify the optimal harvest age in which the material obtained presents the most suitable physical and chemical characteristics for production.

The success of these systems depends on the knowledge of the effect of the soil-pasture-animal interaction on the availability and nutritional quality of the pasture, given that there are many factors that influence the expression of forage material, among which the level of nutrients in the soil. To achieve a pasture with optimum availability of dry matter and nutritional quality, it is necessary to satisfy the requirements of the crop, which depends directly on the level of nutrients in the soil.

Livestock is undoubtedly one of the main fields that must be considered for the preservation of its potential. In this sense, small and medium livestock producers must adopt practices that allow the recovery of soils and increase the production and nutritional value of forages in a sustainable context [16].

For all the aforementioned, the following research work was proposed with the general objective of identifying the best cutting season of elephant grass, with the specific objectives of measuring the heights of the plants, determining the percentage content of green matter and dry matter, determine the protein percentage content of the elephant grass in the different cut intervals.

2. MATERIALS AND METHODS

2.1 Geographical framework and reference of the experiment location

The location of the facility is located in the community of Salinas cue district of Horqueta, about 5 km away from said city in the department of Concepción, Paraguay. The coordinates belonging to the place of the experiment are the following UTM (23 ° 17'6.795 "S, 57 ° 4'13.9" W.) The bromatological analysis was carried out in the Facultad de Veterinaria de la Universidad Nacional de Concepción.

2.2 Climate and soil characteristics

The climatic type of the zone is characterized by having an average temperature of between 26 and 14 ºC with a maximum of 45 ºC in summer situations and a minimum of 4 ºC in winter season, they are slight incidences of frost. The levels of precipitation is around

1750 mm, annual average. The rainiest months are November, December and January, with an annual rainfall of 156 mm per month; and the driest, June, August and September, in which the average rainfall is 57.1 mm. The prevailing winds are from the north, east and southeast [6].

The soil is classified as red latosol, sandy loam texture, red in color and of medium to low fertility suitable for agriculture and livestock [11].

2.3 Experimental design

The experimental design used was completely randomized with 4 treatments and 5 repetitions. The treatments consisted of different intervals of cuts of the elephant grass as detailed in Table 1.

Table 1. Description of the treatments. Concepción, Paraguay, 2017

Treatments	Description (Intervals of cut)
T1	70 days
T2	60 days
T3	50 days
T4	40 days

The dimensions of the experimental units (EU) were 9 m2 (3 x 3m) in total 20 EU, an area of 180 m2 was obtained.

2.4 Installation process

The experimental process began with the uniformization cut, carried out with a bowie knife in March 2017, in order to allow the regrowth of the grass, at the same time the cleaning of the plot was also carried out eliminating all types of weeds that could interfere in the growth of the grass and later delimitation of the area of the experiment. During the course of the experiment fertilizations were not carried out, so it was not necessary to carry out applications of phytosanitary products. Once the cut day arrived, for each of the treatments, it was performed at a height of 10 cm from the ground for the corresponding evaluations. The experimental period was 70 days, to obtain the determinations.

2.5 Determinations and evaluation procedures

Height: For this determination a tape measure was used to measure the total height of the plant, from the neck of the plant to the tip of the highest leaf, expressing the results in meters.

Green matter: Within the experimental unit an area of 0.25 m2 was chosen at random, in which the material was cut to determine the weight of the same, the results were expressed in Mg ha^{-1}.

Dry matter: For this determination the green grass grass cut sample was used, which was dried in full sun until the samples had a constant weight, the results were expressed in Mg ha^{-1}.

Gross Protein: For the determination of the nitrogen contained in organic matter, the Kjeldahl method was used [7].

2.6 Analysis of the data obtained

The values obtained for each of the determinations were subjected to analysis of variance by the Fisher Test to 5% to evaluate if there were significant effects of the treatments and if positive, for those determinations affected, the means of each of them regression analyzes were performed.

3. RESULTS AND DISCUSSION

Figure 1 shows the regression performed to determine the height of the plant in the elephant grass (Pennisetum purpureum) related to the treatments (intervals of cut). The generated equation is y = 0.0204x-0.057; thus also the coefficient of determination (R2) which was 0.93; that is, 93% of the total sum of squares of the determination height is explained through the linear relationship.

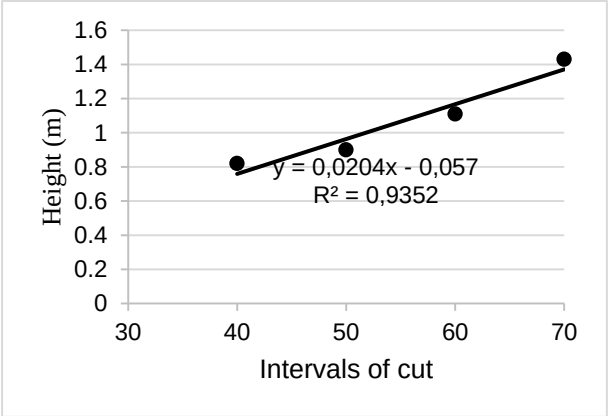

Figure 1. Regression for the determination of height of the plant relating to the treatments (cut days). Concepción, Paraguay, 2017.

As can be seen in Figure 1 of the equation obtained, for each 0.0204 increase in the number of days, 0.057 meters increase in the height of the plants. In the T1 = 70 days, T2 = 60 days, T3 = 50 days and T4 = 40 days were obtained averages of 1.43; 1,11; 0.9 and 0.82 meters respectively. Similar results were obtained by [18] that working with different cultivars of Pennisetum purpureum and a cut interval of 45 days obtained means similar to those found in the experiment corresponding to the cultivar used.

The treatments T3, T2 and T1 had a growth superior in 10, 35 and 74% respectively in relation to

the T1, this behavior could have occurred because the grass elephant and all the grasses in general have a similar behavior, that when increasing the amount of days of cutting or grazing tend to increase the height of the same by the need to capture solar energy for the process of photosynthesis.

Analogous results were pointed out by [3] that working with influence of cut age on forage performance of elephant grass found averages of 0.60 m. and 1.73 m. at 28 and 84 days respectively.

In Figure 2 for the green mass determination it is observed that the equation generated is y = 0.2162x-7.8408; thus the coefficient of determination (R2) which was 0.92; that is, 92% of the sum of the total squares of the green mass determination is explained through the linear relationship.

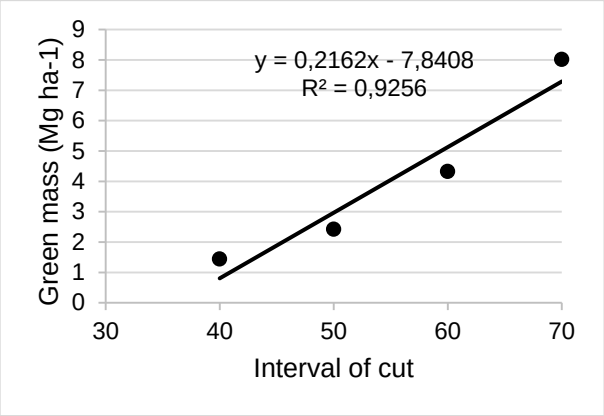

Figure 2. Regression for the green mass determination relating to treatments (interval cut days). Concepción, Paraguay, 2017.

The determination of green mass had an ascending behavior, increasing the number of days also increased its content of green matter due to the time factor, as can be seen in Figure 2. It was obtained in T4: 1.44 Mg ha-1 and in T1: 8,012 Mg ha-1, that is, the difference was 6,572 Mg ha-1.

Regarding the experiment, the results found by [2] disagree with the results of this experiment, they found yields of green mass in grass of the genus Pennisetum in regrowth harvested at 70, 84, 98 days obtained 11, 12 and 14 Mg ha-1.

Also [8] in cuts made at 1, 2, 3 and 4 months of age of elephant grass obtained productions of 16, 20, 43 and 55 Mg ha-1, data much higher in relation to those reported in the present work.

In Figure 3 for the determination of green mass it is observed that the generated equation is y = 0.085x-3.29. Thus the coefficient of determination (R2) that was 0.89; that is, 89% of the total sum of squares of the green mass determination is explained through the linear relationship.

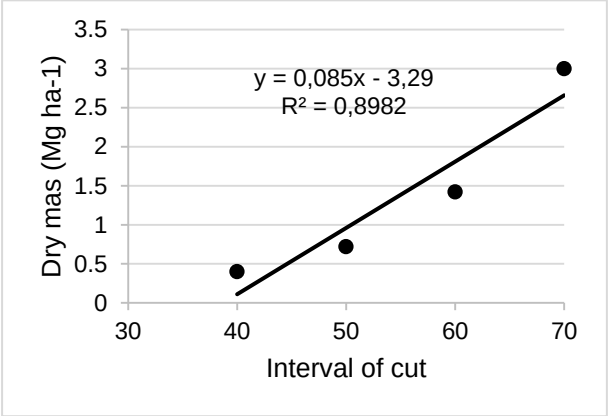

Figure 3. Regression for the dry mass determination relating to the treatments (cut days). Concepción, Paraguay, 2017.

The amount of dry matter is a function of the growth time of the grass, since as the age of the shoots increases, more dry matter accumulates, both in leaves and stems and these differences are clearly reflected in the results of the work in Figure 3.

In the experiment, T4 0.4 Mg ha-1 was found in T4, 0.72 Mg ha-1, for T2 1.42 Mg ha-1 and in T1 3 Mg ha-1.

These values proposed in this experiment are below those found by [14], who evaluated the dry matter in elephant grass every 56 days of cut obtained yields between 8 and 16 Mg ha-1.

Likewise, the values of dry matter production found in this test with elephant grass are lower than those reported by [17] of 11.85 Mg ha-1, in the same way, lower than those found by [9]González et al. (2007) of 4.6; 5,7; and 5.7 Mg ha-1 at 30 60 and 90 days respectively.

Table 2 contains the crude protein means for elephant grass for the independent variables, with all treatments being statistically equal to each other, that is, no significant differences were recorded between the treatments. With a coefficient of variation of 13.82%.

Table 2. Comparison of means for crude protein determination in Pennisetum purpureum. Concepción, Paraguay, 2017.

Treatments	Description	Crude protein (%)	
T2	60 Days	6,46	A
T3	50 Days	6,43	A
T1	70 Days	6,35	A
T4	40 Days	5,34	A
	C.V(%)	13,82	

Means followed by the same letter do not differ from each other, by the Tukey test at 5% probability. C.V: Coefficient of variation

The decrease of the protein content of the grass with the age of the regrowth, is due to the lignification of the cell walls of the plants, the stems begin toughen as the days pass from the cut made of said material and the consequences of that begin to lose the protein nutritious content.

In T1 = 70 days, T2 = 60 days, T3 = 50 days and T4 = 40 days averages of 5.34 were obtained; 6.43; 6.46 and 6.35% of crude protein respectively.

These results agree with [15] that reported values of 5.35% crude protein at 60 days, values that closely resemble the results obtained in this experiment with the same plant species.

But the data found in this experiment are different from those found by [5] whose protein content at 42 days was 13.6%.

In the same way, [10] found that at 49 days the elephant grass reached crude protein levels of 11.24%, this value being higher than that obtained in this test.

Also [13] determined that the crude protein content for the grass Pennisetum purpureum at 35, 45 and 60 days was 12.46 10.80 and 7.12% respectively, these results being higher than the one collected in the present experiment with the cultivar used.

4. CONCLUSION AND RECOMMENDATION

The cuttings of the elephant grass positively influence the variables studied, reaching better percentages of crude protein at 60 days and the other variable obtained better at 70 days.

Taking into account the criteria of production and quality of the pastures, the results of the research allow us to recommend the 60-day interval as the best harvest time for elephant grass, which guarantees a good qualitative and quantitative contribution of the harvested biomass.

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