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RESPONSE OF CUT CAMERUM, CT-115, OM-22 AND MARALFALFA FORAGE PASTURES TO THE BIOFERTILIZER BIOCAFÉCASHI, CHIAPAS

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Abstract: The objective of the present investigation was to evaluate the interaction between cutting grasses with the doses of Biocafécashi biofertilizer, carried out with the varieties of cutting grasses Cameroon, Maralfalfa, CT-115 and OM-22 to detect the most resistant variety to the dry and rainy season with greater production. Four varieties of cutting grasses were evaluated in a randomized complete block experimental design with a 4 x 4 factorial arrangement with four repetitions, experimental plots of five 4 m long furrows, with a separation of 0.80 cm between furrows and planting points. with two stakes. The variables evaluated were: plant height, number of leaves per shoot and leaf area. It was recorded that the average height was 135.50 and 201.62 cm in the dry and rainy seasons, respectively, with the doses of 3,750 mL and 2,500 mL of the Biocafécashi biofertilizer; For the number of leaves per shoot, it was found that in the dry and rainy season it was 11 and 13.91 leaves per shoot with the doses of 3,750 mL and 1,250 mL and leaf area of 185.86 cm2 and 251.84 cm2 with the dose of 3,750 mL and 1,250. mL of Biocafécashi biofertilizer for the dry and rainy seasons in Cameroon grass. The best interactions occurred with Cameroon grass at a dose of 1,250 mL and it was the most resistant to dry and rainy seasons.
Keywords: Pastures, forage, biofertilizers, dry season, seasonal.

INTRODUCTION

The CT-115 grass is native to Cuba, known in the Frailesca region as Cuban grass, its scientific name (*Pennisetum purpureum S.*), selected from several mutants obtained by tissue culture (Martínez et al., 1996). A grass with extraordinary nutritional qualities for livestock, CT-115 grass, obtained by biotechnological method at the Institute of Animal Science (ICA) of Cuba, is gaining space in the country's livestock units and companies, of course, in those of the country. originally. According to specialists, it is a variety of the so-called Elephant (P. purpureum). It was possible to achieve this by in vitro cultivation of a King grass clone (Barreras, 2007). CT-115 grass, under favorable conditions, can produce from 300 to 400 t ha-1 of green forage, which means 28 to 34 t ha-1 of dry matter. Its crude protein content varies from 10 to 12%, with a digestibility of 80% and supports an animal load of 2 to 3 AU ha-1 in the rainy season and 1.5 to 2 AU ha-1 in the dry season (French, 1975).

The hybrid OM-22 was obtained by crossing P. purpureum Cuba CT-169, obtained at the ICA, with P. glaucum Tifton Late, donated to Cuba by Glen W. Burton of the Coastal Plain Experiment Station, it was selected from more of 50 F-1 individuals, due to their high proportion of leaves, longer (1.4-1.7 m) and wider (5 to 8 cm) in the rainy season and very tall (2.2 to 3 m), especially in the dry season. rainy when compared to other varieties of elephant grass grown in Cuba. In addition, it is distinguished by the lack of villi, something very acceptable by producers for manual cutting, and the last third of the plant is less lignified, very palatable for livestock, with a high protein content of 15 to 18% and can reach 16-20 t of DM ha-1 year-1 in the dry period (Martínez and Serrano, 2006). These same authors state that their stems are distinguished by having a low height in the dry period (85 cm at 90 days) with 3 to 5 cm thickness and a length of their internodes of 12 to 14 cm.

The origin of Maralfalfa grass (Pennisetum sp) is still very uncertain. There are several hypotheses in this regard, among which is that of the Jesuit priest José Bernal (1979) who claimed that it was the result of the combination of several forage resources among which are elephant grass (P. purpureum),

a native grass (Paspalum macrophylum K.), gramalote (Paspalum fasciculatum K.), Peruvian alfalfa (Medicago sativa L.) and Brazilian grass (Phalaris arundinacea L.). He also maintained that this grass was his creation as a result of the application of the so-called Biological Chemical System (S.Q.B), developed by this same author and which is property of the Javeriana University (Correa et al., 2004). On the other hand, Hanna et al. (1984), points out that this grass was the result of the hybridization of P. americanum (L.) Leeke with P. purpureum Schum, this hybrid is a triploid that can be easily obtained and combines the nutritional quality of the forage of P. americanum with the high dry matter yield of P. purpureum.

Cameroon grass was discovered in South Africa in 1908, this plant has spread throughout the world. It tolerates acidic or moderately alkaline soils, but not the presence of salt. It prefers humid lands, although not swampy ones. The highest yields are obtained in fresh, slightly clayey or sandy soils. It tolerates drought poorly, during which, when growth stops, the stems become threadlike and the leaves very small. Forage yield can reach 180 t ha-1 in optimal growing conditions, with mowing at 0.80 cm every twenty days. According to the experiences carried out in Peradenya, it seems that it is appropriate to mow at six-week intervals, when nitrogen fertilizers, such as ammonium sulfate, are used.

Biofertilizers work mainly inside plants, activating the strengthening of nutritional balance as a defense mechanism, through organic acids, growth hormones, antibiotics, vitamins, minerals, enzymes and coenzymes, carbohydrates, amino acids. and complex sugars, among others, present in the complexity of the biological, chemical, physical and energetic relationships established between plants and soil life.

MATERIALS AND METHODS

STUDY LOCATION

La investigación se llevó a cabo en el Rancho "El Jobo", propiedad del productor Octavio Rodas del municipio de Villa Corzo, Chiapas, ubicado en el tramo carretero Villaflores-Villa Corzo, rumbo al auditorio municipal de Villaflores, km 3. Sus coordenadas son Latitud Norte 16°12'58.90" y longitud oeste 93°14'46.80"0. A una altitud aproximada de 590 msnm (INEGI, 2001). El clima es cálido subhúmedo intermedio Aw" 1(w) (i) g; presenta lluvias en verano, con una precipitación pluvial anual average de 1,200 mm y una temperatura media anual de 22° C (García, 1987).

EXPERIMENTAL DESIGN

The experimental design was in a Random Complete Block arrangement (BCA) with a 4 (Control) and four varieties of grasses: B1: CT-115 Grass, B2: OM-22 Grass, B3: Cameroon Grass and B4: Maralfalfa Grass, respectively, where each treatment*variety interaction was composed of four repetitions. Half a hectare of land was used.

PREPARATION OF THE PLANTING AREA

The preparation of the land consisted of one step of plowing and two tracking and furrowing of 80 cm. The grass varieties used were in their mature phase. In the sowing of the pastures, twigs were used, with three nodes, they were placed at a distance of 50 cm from each other, at an approximate depth of 15 cm, having a planting density of 25,000 twigs per hectare.

VARIABLES EVALUATED

The variables that were evaluated were: the height of plants per plot; The number of live leaves per shoot per plot was counted and the leaf area of different plants per plot was measured, taking five plants for each variable, respectively.

APPLICATION OF BIOCAFÉCASHI BIOFERTILIZER

The Biocafécashi biofertilizer was applied at different doses (1,250 mL, 2,500 mL, 3,750 mL and control 0 mL) to the pastures, these applications were made every 15 days in the mornings.

ANALYSIS OF DATA

The data obtained were analyzed using the SAS (Statistical Analysis System) program to perform an analysis of variance between the pasture variables and the biofertilizer doses. The Tukey multiple test of means was also determined.

RESULTS AND DISCUSSION

The height was 135.50 cm in the Cameroon grass in the dry season at the 3,750 mL dose of the Biocafécashi biofertilizer and for factor A, significant statistical differences were found, with a height of 103.56 cm at the 3,750 mL dose of the Biocafécashi biofertilizer (Table 1). The lowest plant height recorded was 85.44 cm with the interaction of Maralfalfa grass at the dose of 2,500 mL of the Biocafécashi biofertilizer (Table 1). The Cameroon grass had an average height of 119.62 cm in the dry season, with significant statistical differences found at the dose of 3,750 mL of the Biocafécashi biofertilizer (Table 1).

Factor A* Factor B	0 mL	1,250 mL	2,500 mL	3,750 mL	Average
Cameroon	111.17	114.90	118.39	135.50	119.99a
OM-22	94.74	93.47	94.86	87.32	92.60b
Maralfalfa	92.84	88.15	85.44	93.99	90.11b
CT-115	81.17	99.52	86.82	97.44	91.24b
Average	94.98a	99.01a	96.38a	103.56a	

Table 1. Plant height (cm) in the dry season.

The means in the column with the same letters are not statistically different

(P>0.01); Tukey's multiple range test.

The height recorded was 201.62 cm for the Cameroon grass in the rainy season (Table 2), having a difference of 83.23 cm between the dry season with the dose of 2,500 mL of the Biocafécashi biofertilizer. Likewise, the minimum plant height found was 137.20 cm for the CT-115 grass at the dose of 3,750 mL of the Biocafécashi biofertilizer (Table 2).

Factor A/ Factor B	0 mL	1,250 mL	2,500 mL	3,750 mL	Average
Cameroon	186.67	195.53	201.62	195.26	194.77a
OM-22	174.04	149.34	150.53	148.16	155.52b
Maralfalfa	135.08	151.93	159.45	159.16	151.41b
CT-115	150.21	154.37	150.82	137.20	148.15b
Average	161.50a	162.79a	165.61a	159.95	

Table 2. Plant height (cm) in the rainy season

The means in the column with the same letters are not statistically different

(P>0.01); Tukey's multiple range test.

These results coincide with those of Córdoba (1999) who mentions that differences in plant heights may be due to meteorological conditions, which are sometimes very favorable, since sometimes the moisture content in the soil is satisfactory; obtaining high averages in terms of characteristic, thus these results are similar to those obtained by Coutiño (1984), who found that the height of the plant depends on water consumption. On the other hand, López (1992) states that the greater height, in monoculture, is the result of non-competition for water, light, nutrients and space.

For the number of leaves per shoot, significant statistical differences were found in the grass varieties; the Cameroon grass recorded 11.74 leaves per shoot per plant with the 3,750 mL dose of the Biocafécashi biofertilizer in the dry season (Table 3). According to the minimum average of 9.29 leaves per shoot per plant for CT-115 grass with the 3,750 mL dose of Biocafécashi biofertilizer (Table 3), in the dry season.

Factor A * Factor B	0 mL	1,250 mL	2,500 mL	3,750 mL	Average
Cameroon	10.75	10.76	10.75	11.74	11.00a
OM-22	9.96	9.73	9.53	8.44	9.42b
Maralfalfa	9.24	9.65	9.10	9.41	9.35b
CT-115	9.38	9.26	9.51	9.29	9.36b
Average	9.83a	9.85a	9.73a	9.72a	

Table 3: Number of leaves per shoot in the dry season
The means in the column with the same letters are not statistically different (P>0.01); Tukey's multiple range test.

For the number of leaves in the rainy season it was not significant; However, the grass with the best average of 13.48 leaves per tiller per plant was for the Cameroon grass, while it was followed by the average of 13.02 leaves per tiller per plant for the CT-115 forage grass (Table 4). The interaction with the value of the highest average 14.03 leaves per shoot per plant for the control grass CT-115 and the interaction with 11.43 leaves per shoot per plant was for the OM-22 grass at the dose of 1,250 mL of the biofertilizer Biocafécashi (Table 4).

Factor A* Factor B	0 mL	1,250 mL	2,500 mL	3,750 mL	Average
Cameroon	13.36	13.91	13.11	13.54	13.48a
OM-22	12.50	11.43	12.07	12.08	12.02a
Maralfalfa	12.14	12.70	12.47	13.47	12.70a
CT-115	14.03	12.38	12.83	12.81	13.02a
Average	13.01a	12.61a	12.62a	12.98a	

Table 4: Number of leaves per shoot in the rainy season.
The means in the column with the same letters are not statistically different (P>0.01); Tukey's multiple range test.

The number of leaves in the Cameroon grasses, CT-115 and OM-22, coincide with the average data found by Gamarra (1985) where he also explains the importance of the leaves, which is where the photosynthetic tissues lie and although the total production of dry matter of grasses with a good proportion of leaves is low.

The leaf area found recorded highly significant differences, with Cameroon grass being the tallest with an average of 187.20 cm2 followed by OM-22 grass with 151.39 cm2; However, the highest average recorded was 209.65 cm2 for the control (Table 5) and the lowest recorded height was 135.63 cm2 with the 2,500 mL dose of the Biocafécashi biofertilizer.

In the interaction Factor A * Factor B, the highest average recorded was 209.65 cm2 for the Cameroon grass for the control and the lowest average was 100.77 cm2 for the Maralfalfa grass with the 3,750 mL dose of the Biocafécashi biofertilizer (Table 5).

Factor A * Factor B	0 mL	1,250 mL	2,500 mL	3,750 mL	Average
Cameroon	209.65	176.06	177.23	185.86	187.20a
OM-22	160.43	128.49	144.20	172.44	151.39b
Maralfalfa	109.61	117.82	113.22	100.77	110.36c
P115	110.37	121.65	107.88	118.94	114.71c
Average	147.52a	136.00a	135.63a	144.50a	

Table 5. Leaf area (cm^2) in the dry season.
The means in the column with the same letters are not statistically different (P>0.01); Tukey's multiple range test.

Regarding the leaf area in the rainy season, highly significant differences were found for factor B, with Cameroon grass being the most outstanding with an average of 239.36 cm2 (Table 6). For factor A, no statistically significant data was found; However, the highest average of 251.84 cm2 was recorded by the dose of 1,250 mL of the Biocafécashi biofertilizer (Table 6). The interaction Factor

A * Factor B, the highest mean of 198.49 cm2 was for the Cameroon grass with the dose of 1,250 mL of the Biocafécashi biofertilizer and the lowest mean was 144.97 cm2 for the CT-115 grass with the dose of 3,750 mL of the same biofertilizer. (Table 6).

Factor A * Factor B	0 mL	1,250 mL	2,500 mL	3,750 mL	Average
Cameroon	234.93	251.84	226.58	244.08	239.36a
OM-22	221.66	191.17	178.22	193.36	196.1b
Maralfalfa	157.68	162.84	155.89	169.34	167.68b
CT-115	158.88	188.10	178.76	144.97	161.44b
Average	193.29a	198.49a	184.86a	187.94a	

Table 6: Leaf area (cm2) in the rainy season

The means in the column with the same letters are not statistically different (P>0.01);

Tukey's multiple range test.

Hernández and Guenni (2008) mention that tropical pastures have a greater capacity to take advantage of solar radiation, when they reach their maximum production with the presence of greater leaf area. For Gutiérrez (1986), the goals pursued in animal nutrition is the amount of leaf material present in the meadow, since whatever the species, they prefer to consume leaves due to the physical and chemical advantages it offers.

CONCLUSIONS

For the variable plant height, significant data were obtained, for factor B resulting in Cameroon grass in both dry and rainy seasons; For factor A, no significant data was found, but the highest mean was 103.56 cm recorded for the dry season with the dose of 3,750 mL of the Biocafécashi biofertilizer; For the rainy season, the highest average for factor B was 194.77 cm with the dose of 2,500 mL of the Biocafécashi biofertilizer. For the variable number of leaves per shoot, no significant data were obtained for the rainy season, but for the dry season in the grass varieties, Cameroon grass being in both seasons, having in the dry season an average of 9.85 average leaves with the dose of 1,250 mL of the Biocafécashi biofertilizer and 13.01 average leaves for the rainy season with the control.

With the variable leaf area, statistically significant data were obtained for factor B, with the Cameroon grass standing out in both seasons with an average in the dry season of 187.20 cm2 and in the rainy season an average of 230.36 cm2. It was observed that for all the variables the Cameroon grass was the one that stood out, it was found that this is a very rustic grass followed by the OM-22 grass which, although it had a hard time adapting under these conditions.

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