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RESEARCH ARTICLE

AGRONOMY OF MULATO GRASS CULTIVAR (BRACHIARIA SP.) IN GRAZING CONDITIONS IN QUINTANA ROO, MÉXICO

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Abstract

The objective of this study was to determine the behavior of "Mulato" grass under grazing conditions in Quintana Roo. This work was carried out in the Chetumal Experimental Field of INIFAP in Quintana Roo, which is located 25 km from Chetumal, in the vicinity of the Juan Sarabia ejido, on km 25 of the Chetumal federal highway. For the development of the study, two hectares were used, 1 ha of Brachiaria humidícola (Chetumal) and another of Brachiaria sp. (mulato). For each type of pasture, three recently weaned steers of the Holstein for Zebu and Swiss for Zebu breeds with an approximate initial weight of 242 ± 3 kg were used; the variables measured were seasonal dry matter production, plant cover and height, forage supply, and the botanical composition of the meadow. Subsequently, the steers were changed by load adjustment and the weight gain was determined. The design used was totally randomized with three repetitions per treatment and the analysis of the information was carried out through the ANOVA. No differences ($P \geq 0.05$) were found in the number of plants 12 weeks after establishment. For the coverage parameter, differences ($P \leq 0.05$) were observed with values of 89% and 77 for Chetumal and mulatto grass, respectively. The values of weight gain among the grasses under study (650 vs 675 for Chetumal and mulatto, respectively) did not indicate differences ($P \geq 0.05$) between them. Therefore, mulatto grass should be considered as an option for livestock in the state.

Introduction:-

One of the problems that face the development in livestock in tropical Mexican condition is the limited uses of forage species (Oosting et al., 2014) as well as adaptation in different agro ecological conditions, the stationarity of forage production and variation in nutritive (Christians and Engelke, 2020). It is important to mention that efficient manage of forage species is primordial to maintain high productivity and quality avoiding land damage. One of the solution to the above problem mentioned has been to diversify forage species and to elevate the productivity through materials introduced with excellent behavior in other regions of America Latin (Cheruiyot et al., 2020; Ku-Vera et al., 2020), however it is necessary to evaluate their adaptation to be considered as potential forage species (Ghahramani et al., 2019) as well as agro ecological adaptation, sustainability and quality per year, plagues and disease resistance, auto propagate capacity among others (Godde et al., 2021; Philp et al., 2019). Brachiaria

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(Urochloa) is a genus, common name Brachiaria of forage grasses that is increasingly transforming integrated crop-livestock production systems in East Africa (Cheruiyot et al., 2020). This generous has showed wide adaptation and it has been used extensively in different tropical countries (Adnew et al., 2021). There are many reports in Quintana Roo about the agronomic and nutritive characteristics of this species, furthermore that it has showed excellent adaptation of environment conditions (Ramírez-Barajas et al., 2019; Laiton Medina, 2019; Montejo-Martinezet al., 2019). Mulato cultivar (B. brizantha X B. ruzizienzis) is an apomictic hybrid of Brachiaria generous that was generate in Tropical Agriculture International Center (CIAT by their Spanish acronym). This variety presents excellent productive potential so to know the productive response in different frequencies and intensities of grazing is an information necessary to design. On the other hand Chetumal cultivar (B. humidicola) grass has showed higher forage production with high stem densities. Due to above mentioned, this research had the objective to evaluate this grass in grazing conditions inside of small plots to determine the productivity through the year.

Materials and Methods:-

Land preparation

The surface evaluated was two hectares in which were cultivated Mulato (Brachiaria brizantha X B. rizizienzis) and Chetumal (Brachiaria humidícola) grasses. Soils were prepared in a conventional way with two steps of plow and two steps of harrow. The grass was sown by spreading uniformity and then covered using a dredger. The density was 7 kg per hectare.

Study area maintenance

A strict control of undergrowth was carried out using agrochemicals and mechanic cleaning. Each year was applied 100-50-00 of NPK as fertilization. Nitrogen was applied at the beginning and the end of raining period, on the other hand phosphorus was applied once at the beginning. When grass growth, it was carried out the division of lands in four sections. Each of one section had 2000 square meters. This division was carried out to do the rotation of animals.

Establishment of experiment

During establishment of mulato grass was carried out agronomic observations to obtain more information of this species. The information was evaluated using the methodology proposed by CIAT (CIAT, 1982). Previously to carry the evaluation of grazing at 6 months before experiment establishment, it was carried out a clear grazing per 28 days to standardize the process. On the other hand, for evaluation was used 3 animals per land of Holstein per Zebu and Swiss per Zebu breed race of 242±3 kg c/u. they were replace when obtained 380 kg of liveweight. This replace was carried out to maintain an adjustment animal load from 1.5 to 3.0 AU/ha (animal unity is equal to 400 kg of liveweight). Criteria to determine the distance time and rest in lands was using grazing pressure. To these criteria were using as high pressure 3.0 kg of DM/100 kg of liveweight, medium pressure 4.5 kg of DM/100 kg of liveweight and as low pressure 6.0 kg of DM/100kg of liveweight. Those criteria were used to determine changes and periods of grazing in two precipitation seasons (from February to May and from June to October). The sampling technique used to determine the production of Dry Matter (DM) was the comparative sample double and to determine the condition, botanic cover and high were used fixed transects. Management of lands were carried out in rotational way at the beginning with 7 days of occupation per 28 days of rest. Animals were provided with water permanently.

Evaluation of experiment

Variables to measure were the condition of land before and after grazing, for this was necessary to measure the plant size in 25 points of each area. Grass offer and dry matter production estimation with area of 0.25 square meters. The technique used was comparative double sample. Furthermore the botanic cover was determine with three fixed transects of five meters long. On the other hand, animals were weighted each 56 days in the morning without any previous feed and without have drunk water last day. The experiment was random completely design with three replicates per treatment and information was analyzed by ANDEVA analysis in SAS software.

Results and Discussion:-

The precipitation recorded through the year of establishment was 1172 mm, distributed in 98 days with rain. The least rainy months were April with 0.2 mm, June with 158.2 and October with 162 mm.These values are within the recommended precipitation ranges for the physiographic adaptation of Mulatto grass, which indicate heights from 0 to 1700 meters above sea leveland precipitation from 700 mm onwards(Figure 1).

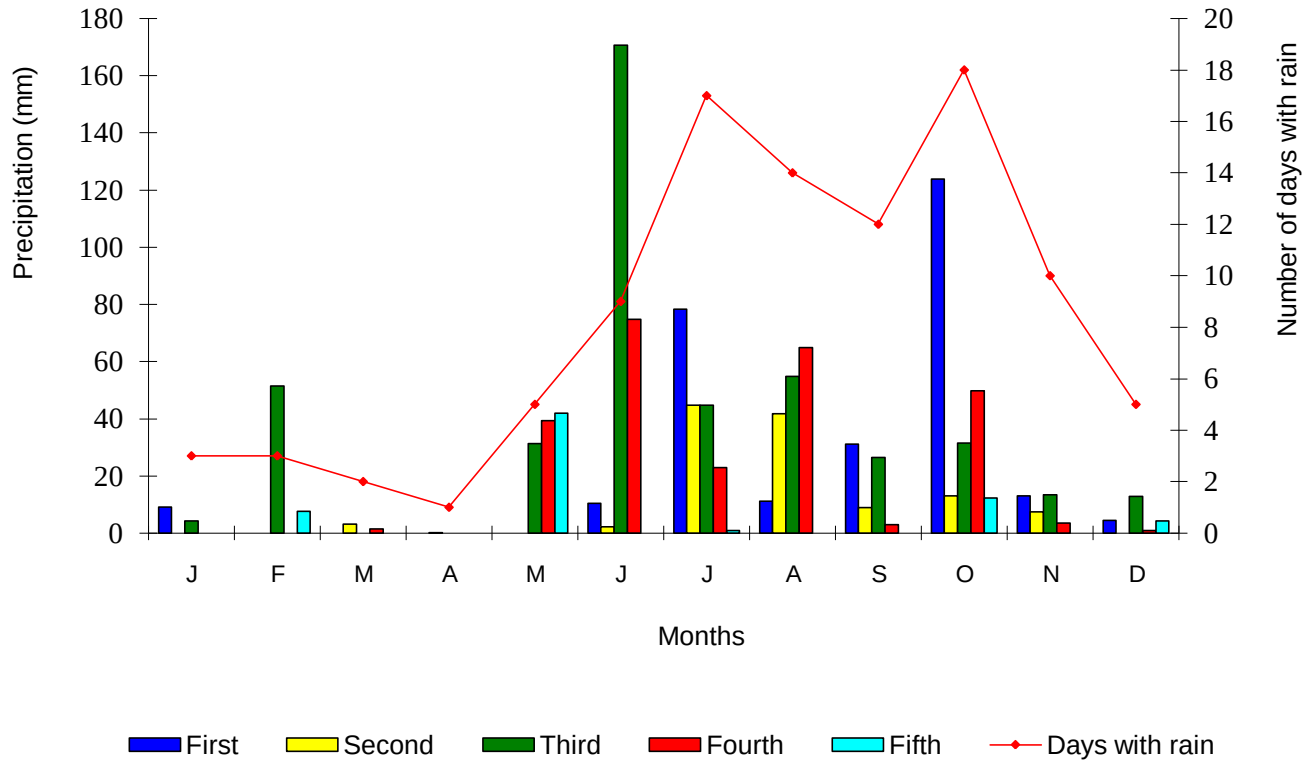

Figure 1:- Precipitation recorded during one month in Chetumal Experimental field of INIFAP. Colors meaning the weeks per month of evaluation.

The establishment time of Mulatto grass was 150 days with a coverage above 80%, which does not agree with that mentioned by other authors (CIAT, 2001) who indicated that it is possible to obtain an established grassland between 90 and 120 days, with coverage greater than 80% under tropical conditions. This could be because of the greater presence of mainly grasses, which made difficult to use herbicides. No differences were found ($P \geq 0.05$) in number of plants at 12 weeks of establishment for the two pastures with an average of 25 plants/m^2. For the coverage parameter, differences were observed ($P \leq 0.05$), since it was greater at twelve weeks after establishment, with values of 89 and 77% for Chetumal and Mulato grass, respectively. This could be to the greater competition with other grasses and the Mulatoas well as the type of growth. For the variable plant height, at twelve weeks no differences were observed between treatments ($P \geq 0.05$), the values observed were 60 and 62 cm, respectively. When carrying out the evaluation of pests and diseases, the isolated presence of fungi of the genera Fusarium and Rhizoctonia was observed. These fungi have also been reported in Brazil and the USA; the incidence, however, was lower in pastures under grazing where the foliage was periodically consumed by the animals, and it tends to disappear, but the damage has not been of economic importance (Pizarro, 2005).In respect with the management of Mulato and Chetumal grasses, for mulatto grass, its recovery capacity allows grazing between 18 and 28 rest days (Guiot and Melendéz, 2002).

The results of the monthly samples of forage supply and coverage showed that in the first 4 months of the trial (October, November, December and January) the dry matter supply of the forage was higher in the Mulato grassland ($P \leq 0.05$) compared to that of Chetumal grass, but from the beginning of the months with less precipitation, the forage yield of the two Chetumal and Mulato grasses was reduced(Table 1). For the months where the precipitation begins again, increases in the production of dry matter and percentage of cover for the two pastures are observed. These values of forage on offer are similar to those observed in other studies where the effect of stocking rate on the persistence of grasses of the genus Brachiaria was evaluated, with periods of occupation and rest of 5/25 (Lovo and Sandoval, 2002). However, these yields are higher than those reported for this grass in Costa Rica, in inseptisol soils of medium fertility, where 2 tons/dm/ha were obtained at the time of maximum precipitation and 1 ton/dm/ha in the

rainy season in minimum precipitation (Argel et al., 2007). The condition of the grassland was maintained as shown by the data in Table 1, where it was observed that the coverage has been high for the two grasses under study, similar results have been reported in various studies evaluating the effect of the animal on the grassland (CIAT, 2001), where it was observed that under the use of medium and low loads the condition of the grassland is not affected and the coverage remains stable (Silva, 2003).

Table 1:- Results of cover and offer in Mulato and Chetumal Grass evaluated in a rotational manner with 7 days of occupation for 28 days of rest.

	Mulato grass		Chetumal grass	
Sample date	Offer of DM ton/ha	Cover	Offer of DM ton/ha	Cover
October, 1	3.78	80 %	1.73	92 %
November, 2	3.41	85 %	2.18	95 %
December, 3	1.98	77 %	1.12	87 %
January, 22	2.08	88 %	1.18	95 %
March, 22	0.91	92 %	0.94	90 %
April, 20	0.99	92 %	0.97	95 %
May 17	0.98	90%	0.96	93%
June 21	1.2	87%	1.0	89%
July 20	1.97	92%	1.10	90%
August 23	3.0	96%	2.05	92%
September 19	3.9	98%	2.67	93%

DM= Dry Matter.

The data on the botanical composition of the grassland are presented in Table 2, where it can be seen that the values are similar for the two grasses under study. These values woody plants are low and are mainly due to a good cover of grasses and their ability to compete, which prevented the growth of undergrowth in grassland. These results are similar to those reported in other studies carried out in Venezuela and Tabasco, Mexico, when were indicated that this grass also grows in the form of tillers and that it shows excellent recovery after cutting and/or grazing due to its regrowth mechanism. (Guiot and Melendez, 2002; Pizarro, 2005).

Table 2:- Botanical composition (%) of the grasslandwith Mulato and Chetumal grasses.

Undergrowth type	**Mulato grass**	**Chetumal grass**
Narrow leaves	2.5^{a}	2.3^{a}
Broad leaves	2.0^{a}	2.1^{a}
Woody plants	0.5^{a}	0.5^{a}

Different literals between columns differ statistically $P \leq 0.05$.

In respect with animal weight gain, it was no detected significatestatistical differences due to values obtained 650±2 and 675±3 g/animal/day in Chetumal and Mulato grasses respectively (table 3).

Table 3:- Effect of the grasses under study on the increase in live weight of steers.

Treatments	**Animal load**	**Average starting weight (g)**	**Animal weight gain (g/animal/day)**	**Kg/animal**
Chetumal	1.5/AU/ha	234±2	650 ± 2^{a}	136.5 ± 2^{a}
Mulato	1.5/AU/ha	241±1	675 ± 3^{a}	141.7 ± 3^{a}

AU: Animal unit. Different literals between columns differ statistically $P \leq 0.05$.

No differences were observed between the two grasses under study ($P \geq 0.05$), possibly due to the prolonged dry period, which significantly reduces the quality of the forage offeredand avoided using loads greater than 1.5/U.A./ha. These results are not similar to those reported by Enríquez (2002), in grazing tests for meat production

on vertisol soils in Huimanguillo, Tabasco, using a stocking rate of 1.5/U.A./ha, who found that the best weight gains daily per animal were obtained in the driest months with average values of 650 g/animal/day, and that the gains obtained in the Mulato cultivar were 153% higher than the weight gains obtained with B. decumbens.They are also higher than those observed in Huimanguillo, Mexico, where average gains of 435 g/animal/day were obtained in Mulato pastures with a stocking rate of 4 heads/year (Guiot and Melendez, 2003).

Conclusions:-

The mulatto grass has excellent cover 5 months after planting, which allows grazing on this date after cutting. Once the grassland was established, no weed problems were observed due to the effect of grazing, since the coverage was quite high. The supply of forage is reduced due to the effect of the low rainfall season, as could be observed; however, this is greater than that reported in other places in Mexico. In general, the preliminary performance of meat gain/day was encouraging and indicative to continue with greater emphasis on research on this grass. The grasses of the genus Brachiaria represent a good option for livestock in the Mexican tropics, since there is a great variety of them that adapt to a great diversity of ecosystems, which allows the rancher to select the most appropriate for their system of production.

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