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Effect of Trampling on the Production of Six Ecotypes of Brachiaria in Nioka, Ituri Province, DRC

Bofunga, M[1], Christophe, Myonge .L[2], Lokinda. L[3] and Bondombe[4]

[1]Researcher at INERA – Nioka, DRC

[2]Assistant at UNIKI – Faculty of Agronomy, DRC

[3,4]IFA –Yangambi, DRC

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ABSTRACT

A study on the influence of trampling on the biomass production of six *Brachiaria* ecotypes, namely *Brachiaria decumbens cv Bazilisk; Brachiaria mulato; Brachiaria brizantha cv Xaraes; Brachiaria ruziziensis; Brachiaria brizantha cv Nioka and Brachiaria brizantha cv Piata* at Nioka, was carried out to observe their production and identify those with an interesting resilience to the above-mentioned factor.The experimental set-up was that of randomized complete blocks comprising six treatments (six ecotypes mentioned above) and repeated three times. The six *Brachiaria* ecotypes were subjected to the trampling disturbance factor. The following parameters were measured: recovery rate and speed, tillering, biomass.After observation, the results were as follows:The highest biomass for this factor before and after trampling was obtained by *B. brizantha cv Piata*, while the lowest production was deplored in *B. brizantha cv Nioka* and *B. mulato*.

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1. Introduction

In several provinces of the Democratic Republic of Congo (DRC) in general and that of Ituri in particular, to cope with the continued precariousness of fodder resources and a drop in the productivity of ruminant livestock in this province, the flora prairiale deserves to be renovated and upgraded. The grassland resources of the DRC are almost dominated by various grasses, depending on their plasticity and their fairly high adaptive capacity.

Nowadays, the demographic explosion continues to increase and Ituri being one of the prosperous pastoral provinces, the population is generally agricultural and in search of good land covered by grasses which are more and more coveted by agriculture in the strict sense and the use of bush fire which constitute one of the retrograde practices reprimanded by the millennium issues which only reduce pastureable areas annually.

Brachiaria is adapted to drought and low fertility soils, sequesters carbon through its large root system, improves nitrogen use efficiency and subsequently minimizes eutrophication and greenhouse gas emissions. greenhouse (Subbarao et al., 2009 in Outtara and Louppe, 2018; Arango et al., 2014; Moreta et al., 2014; Rao et al., 2014).

Unfortunately, the trampling of the meadow by domestic animals affects the productivity of the rangelands by the fact that it acts on the normal development of the vegetation and therefore interferes with its productivity. Some authors have shown that the higher the animal stocking rate, the more reduced grassland production is (Bowns and Bagley, 1986 in Onana, 2016; Jeffries and Klopatek, 1987 cited by Roberge, 2018; Sabir et al., 1992 cited by Gramier et Bigot, 2021; Hamel et al., 2019).

It is in this perspective that the present study is limited, which attempts to determine the productivity of forage species in the Nioka region by considering the factor of trampling effects.

1.1. Choice and interest

The choice of this subject is justified by the simple reason that it constitutes a preliminary investigation into the ecotypes of Brachiaria introduced and exploited in Nioka and its surroundings. In addition, knowledge of the fodder potential of these ecotypes and their potential for resistance to anthropogenic stress will allow the Research Center to relaunch the breeding of small and large livestock in Nioka and its surroundings after the effective return of peace in this area part of the Republic with a pastoral vocation.

1.2. Temporal and spatial delimitation

This investigation took place from July 2022 to July 2023, i.e. a duration of one year and carried out in Nioka and its surroundings in the territory of Mahagi, the province of Ituri.

2. Materials and Methods

2.1. Environment and location of the test site

The tests for this study were conducted in the INERA-Nioka concession (figure 1) located at 02° 12' 49.7" North latitude, 030° 38´ 39.5´´ East longitude and at an altitude of 1661 m in part of the food plantation and also next to the collection of Brachiaria spp ecotypes from the Livestock Program as illustrated in the map below. The figure below elucidates the location of our experimental field.

2.2. Ecology of the site

The city of Nioka belongs to the AW2N and AW3N climatic regions defined according to the Käppen classification. The average annual rainfall amounts to 1269

Tele:
E-mail address: christophemyonge@gmail.com

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mm spread over 9 months and the average daily temperature being 18.9°C, is more or less constant throughout the year.

The province of Ituri (Holowaychuk cited by Lebrun, 1969) being generally also in the Sudano-Zambézian zone, Nioka, is represented by high altitude savannahs (>1500m) and the dominant formation of the region includes gallery forests and swampy rivers (Aoda, Luluda River and Shari River). Soils with a black or very dark gray humus horizon, with a medium sub-angular structure. The non-humus solum is clayey or clayey-sandy, friable with a medium sub-angular structure, very dark reddish brown in color above the dark horizon, and reddish brown above. Grano-quartz is present in variable quantities, and determines either the clay type or the clay-sand type (Ruhe, cited by Ngoy, 1993a).

2.3 Material

It was composed of six ecotypes of the Brachiaria genus introduced and exploited in Nioka and its surroundings, notably Brachiaria decumbens cv Basilisk (Bdb), Brachiaria mulato (Bm), Brachiaria brizantha cv Xaraes (Bbx), Brachiaria ruziziensis (Br), Brachiaria brizantha cv Nioka (BbN) and Brachiaria Brizantha cv Piata (Bbp).

2.4 Methods

2.4.1Conduct of the test

The study had two aspects, namely: Evaluation of the biomass production of Brachiaria ecotypes before the intervention of other factors and the effect of trampling on the productivity of these six ecotypes.

2.4.2. Preliminary works

They consisted first of all in the development of the research protocol, then in the identification of the experimental site, taking the geographical coordinates of the field using GPS and finally in bringing together the financial means and some technical equipment for the proper conduct of the research the test.

2.4.3. Identification of study materials

The study material intended for the experiment was identified in the National Collection of Brachiaria located on the Ndjumali farm next to the Zagu forest reserve at INERA-Nioka and for more precision in this identification stage of Brachiaria ecotypes, the INERA-Nioka herbarium service was very useful.

2.4.4. Acquisition of Brachiaria species

The plants that constituted our study material were harvested at the INERA-Nioka Agrostological Garden using a hoe.

3 Experiment itself

3.1. Experimental device and treatments

The test on the evaluation of the production of different ecotypes of the Brachiaria genus before and after the stress considered was carried out according to an experimental design of randomized complete blocks comprising six treatments and three repetitions. Each plot of 5m x 2m, or an area of 10 m2, received 55 shards of stumps installed at spacings of 0.5m x 0.5m, or 0.25m². The 1m aisles separate the plots from each other. The three repetitions were installed at the same time on the side of the same hill. Thus, overall, each device was made up of 990 fragments of stumps and the total area of the field was 342 m2. Note that each factor used in this work was studied by adopting the same evaluation device based on: the production of Brachiaria biomass and the trampling effect. The 6 ecotypes corresponding to the treatments were: Brachiaria decumbens cv Basilisk (Bdb); Brachiaria mulato (Bm); Brachiaria brizantha cv Xaraes (BbX); Brachiaria ruziziensis (Br), Brachiaria brizantha cv Nioka (BbN) and Brachiaria brizantha cv Piata (BbP).

Preparing the land

This preparation first consisted of mowing the grass using a machete and cutter, and removing the shrubs using a pickaxe and a hoe. The hoe was also used for plowing the land and harrowing clods of plowed land and a rake was used when leveling the land.

Preparation of propagation material

The strains used being in the vegetative stage were collected using the hoe and transported to the experimental site by vehicle. The preparation of propagation material consisted first of fragmenting the stumps using a machete, followed by dressing them by hand.

Planting

The 15cm x 15cm x 15cm holes were dug with a hoe and in these, the fragments of the stumps thus obtained were planted at an angle of more or less 60° relative to the plane of the ground. Each pocket included two pieces of stumps and the spacing was 0.5m in all directions. The rope and the metric tape were used for this work. No soil amendment was applied.

Crop care

Weeding was the first maintenance treatment after total recovery using a hoe. This was followed by refilling the observed voids and then stripping them to leave only a single stump to be observed later.

2.6 Comments

The main parameters observed were as follows: the rate and speed of recovery, tillering, biomass production following the different factors constituting the effects of trampling.

a) Recovery rate

Evaluated as soon as at least one new leaf or tiller appears at the base of the splinter. While the time required for recovery was evaluated by considering the number of days from which new growths or tillers no longer appeared. The recovery rate is estimated as a percentage while the recovery speed is defined as the number of days necessary for the total recovery of the planted species. The recovery rate was determined from the following relationship:

$$TR\ (\%) = \frac{(\text{Number of shards having resumed})}{(\text{Total number of shards planted})} \times 100 \quad (1)$$

b) Tilling

It is the vegetative propagation capacity for a burst to produce adventitious secondary shoots from nodes at the base of the initial seedling, thus ensuring the formation of dense clumps. For this parameter, the tillers were counted after 1 month to 12 months and the data taken in a register, using the pen.

c) Production

The estimation of biomass production consisted of cutting 15 stumps per experimental unit with a machete.

The harvest provided by the sample plants was weighed using a precision balance (Steinberg system SBS brand - LW 7500A) reduced to the plot scale, then extrapolated to the hectare. For each ecotype, the aliquot samples taken were dried in an oven at 105 °C until the constant weight was obtained.

b) Aspect 1: Effect of trampling on biomass production

The grassland flora being ready to be appetized, it was then that this parameter was evaluated after the cattle had passed through the field for 6 days, the carrying capacity was 30 cattle which were identified by marking at the level of chamfer of each animal, hungry and driven to graze and trample the meadow flora for 6 hours in the space well fenced and controlled to avoid possible overflow.

e) Tropical cattle unit

To obtain the Tropical Cattle Unit, we considered a 250 kg bovine at maintenance whose daily consumption will conventionally be 6.25 kg DM, which will make it possible to establish a carrying capacity in TLU.

4. Statistical analysis

The Student's t test, one-factorial and two-factorial analysis of variance were used to compare the means and a Bonferoni post hoc test was also used whenever there were differences with the GraphPad software. Prism5 (Graph Pad Software, San Diego, California, USA). The significance level was set at 5%.

4.1. Results, interpretation and discussion

Our results are presented and interpreted as the findings from each figure emerge.

4.2. Biomass production of Brachiaria ecotypes

4.2.1. Average biomass of Brachiaria ecotypes before disturbance factors

Figure 3 below shows the average biomass production obtained before the application of disturbance factors: trampling, burning and grassing.

It appears from this figure 3 that under the conditions of Nioka, B. brizantha cv Piata gives a good biomass yield, i.e. (1273.5 kg dm/ ha), followed by B. brizantha cv Xaraes, with (1078 kg dm/ ha), B. decumbens cv Bazilisk (937.7 kg dm / ha), B. brizantha cv Nioka (802.16 kg dm / ha), B. ruziziensis (802.16 kg dm / ha) and comes so B. mulato (648.32 kg dm/ha).

These numerical differences were confirmed by the analysis of variance which showed highly significant differences (P = 0.001) between the ecotypes.

However, Bonferroni's post hoc test indicates highly significant differences between B. decumbens cv Bazilisk and B. mulato, B. decumbens cv Bazilisk and B. brizantha cv Bazilisk and B. brizantha cv Nioka, B. decumbens cv Bazilisk and B. brizantha cv Piata, B. mulato and B. brizantha cv B. brizantha cv Xaraes and B. ruziziensis, B. brizantha cv Xaraes and B. brizantha cv Nioka, B. brizantha cv brizantha cv Piata and B. brizantha cv Nioka and B. brizantha cv Piata (P = 0.0001).

Tropical cattle unit

The biomasses obtained for each Brachiaria ecotype were converted into Tropical Bovine Unit (TBU), presented in the table above.

Table 1. Tropical Bovine Unit of Brachiaria ecotypes (Kg)

Ecotypes / Rehearsals	BdB	Bm	BbX	Br	BbN	BbP
1	0,40	0,28	0,48	0,30	0,35	0,55
2	0,41	0,29	0,47	0,29	0,35	0,55
3	0,39	0,25	0,44	0,29	0,36	0,53
4	0,40	0,28	0,44	0,29	0,34	0,56
5	0,41	0,29	0,48	0,31	0,34	0,56
6	0,43	0,28	0,50	0,29	0,35	0,56
Total	**2,44**	**1,67**	**2,81**	**1,77**	**2,09**	**3,31**
Average	**0,40**	**0,27**	**0,46**	**0,29**	**0,34**	**0,55**

Depending on the maintenance requirement for cattle of 250kg live weight (6.25UF) and taking into account the results obtained under the conditions of Nioka, we note that B. brizatha cv Piata produced (3.39 TLU), followed by B. .brizantha cv Xaraes (2.87 TLU), B. cv. decumbens Basilisk (2.25 TLU), B. brizantha cv Nioka (2.13 TLU),B. mulato (2.02 TLU) and B. ruziziensis (1.83 TLU).

4.2.2. Burst recovery rate of Brachiaria strains

The results on the recovery of Brachiaria ecotypes before and after trampling under study are presented in Figure 4 below.

It appears from Figure 4 that before and after trampling of the meadow by cattle, the recovery rate generally varied from one ecotype to another and it was higher before trampling. Before trampling, the recovery rate was higher in B. ruziziensis (92.7%) and lower in B. brizantha cv Nioka (64.58%).

Analysis of variance showed very significant differences between ecotypes (P=0.0031).

The Bonferroni post hoc test, however, only showed highly significant differences between B. ruziziensis and B. brizantha cv Nioka (P=0.001); and the rest of the ecotypes were not significantly different (P> 0.05). After trampling, B. ruziziensis always had a high rate (82.29%), followed by B. decumbens cv Piata (61.45) and B. brizantha cv Nioka (60.41%); the lowest recovery rate was recorded in B. mulato (50%).

Analysis of variance revealed a highly significant difference between ecotypes (P = 0.006).

However, the Bonferroni post hoc test showed very significant differences between Brachiaria mulato and B. ruziziensis (P = 0.001); it also showed significant differences between B. decumbens cv Basilisk and B. ruziziensis; B. brizantha cv Xaraes and B. ruziziensis (P = 0.01); on the other hand, no difference was found between the rest of the ecotypes (P > 0.05).

By comparing the recovery rate before and after trampling, the two-factorial analysis of variance illustrated highly significant differences between the ecotypes (P = 0.0001).

However, the Bonferroni hoc test only revealed very significant differences before and after trampling for the ecotypes B. decumbens cv Bazilisk and B. mulato (P = 0.001).

4.2.3. Recovery speed

Data on recovery speed before and after trampling are presented in Figure 5 below.

The figure above shows that before trampling, the fastest recovery is seen in B. brizantha cv Xaraes (12 days), followed by B. brizantha cv Nioka (12.16 days). While the slowest recovery is observed in B. ruziziensi (15.83 days) followed by B. decumbens cv Bazilisk (17.33 days); B. mulato (18.00 days) and B. brizantha cv Piata (18.50 days).

Analysis of variance showed significant differences between ecotypes before trampling (P = 0.001). Bonferroni's post hoc test indicates highly significant differences between B. mulato and B. brizantha cv Xaraes, B. mulato and B. brizantha cv Nioka, B. brizantha cv , and B. brizantha cv Piata, and a significant difference between B. decumbens cv Bazilisk and: B. ruziziensis, B. decumbens cv Bazilisk and B. brizantha cv Nioka (P = 0.0001).

The speed of resumption of stump fragments after trampling was most noted in B. brizantha cv Nioka (10.83 days) and B. brizantha cv Xaraes (12.66 days). The rest of the ecotypes were found to be late, including: B. ruziziensis (15.83 days), B. decumbens cv Bazilisk (16.50 days), B. brizantha cv Piata (17.83 days) and B. mulato (18 ,5 days). Analysis of variance indicated highly significant differences between ecotypes after trampling (P= 0.0001).

Bonferroni's post hoc test indicates highly significant differences between B. mulato and B. brizantha cv Nioka, B. brizantha cv Nioka, and B. brizantha cv Piata, B. mulato and

B. brizantha cv Xaraes, B. decumbens cv Bazilisk and B. brizantha cv Nioka, and significant differences between B. ruziziensis and B. brizantha cv Nioka, B. brizantha cv Xaraes and B. brizantha cv Piata (P = 0.0001).

By comparing the situation before and after trampling, the bifactorial analysis reveals no significant difference between the recovery speeds of two situations under observation (P = 0.86).

4.2.4. Pruning of ecotypes of Brachiaria spp

The regrowth of the different ecotypes of Brachiaria before and after trampling are shown in Figure 6.

Figure 6 shows that the greatest tillering before trampling is noted in B. brizantha cv Piata, i.e. (138.83 tillers), followed by B. decumbens cv Bazilisk (119.29 tillers).

While the lowest tillering is evident in B. brizantha cv Xaraes (84.33 tillers). However, the analysis of variance shows no significant difference between the ecotypes examined (P = 0.8935) before grazing.

Furthermore, after trampling, the results obtained show that B. ruziziensis tillered a lot (327.22 tillers), followed by B. brizantha cv Nioka (312 tillers), and B. brizantha cv Piata (227 tillers).

The lowest tillering is noted in B. brizantha cv Xaraes (151.69 tillers). The analysis of variance between the evolution of tillering of these ecotypes after grazing does not indicate significant differences (P = 7.94).

But, by comparing the situation before and after trampling using bi-factorial analysis, we note highly significant differences between all the ecotypes of the two situations studied (P < 0.001).

4.2.5. Biomass of Brachiaria spp

We elucidate in Figure 7 below the biomasses of six ecotypes observed before and after grazing.

Figure 7 indicates that B. brizantha cv Piata produced more bipomass than the other five, i.e. (1218.8 Kg dm/ha) followed by B. mulato (992.93 Kg dm/ha), B. decumbens cv Bazilisk (939.76 Kg dm/ha) B. brizantha cv These numerical differences were confirmed by analysis of variance (P = 0.001).

Bonferroni's post hoc test indicates highly significant differences between B. decumbens cv Bazilisk and B. mulato, B. decumbens cv Bazilisk and B. brizantha cv B. brizantha cv Nioka, B. decumbens cv Bazilisk and B. brizantha cv Piata (P = 0.0001).

On the other hand, after grazing, the biomass differs from one ecotype to another and is presented in decreasing order of magnitude as follows: B. brizantha cv Piata, (1772.46 Kg dm/ha) > B. brizantha cv Xaraes (1502.6 Kg dm/ha) >, B. decumbens cv Bazilisk (1464.83 Kg dm/ha) > (B. brizantha cv Nioka (1400.3 Kg dm/ha) >B. ruziziensis (1326.96 Kg ms/ha) > B. mulato (1322.93 Kg dm/ha) The analysis of variance reveals highly significant differences between the biomass means of ecotypes used in this experiment (P= 0.001). hoc de Bonferroni indicated differences between B. decumbens cv Bazilisk and B. brizantha cv Piata, B. ruziziensis and B. brizantha cv Piata, B. brizantha cv Nioka and B. brizantha cv Piata and very significant differences between B. mulato and B. brizantha cv Piata, B. brizantha cv Xaraes and B. brizantha cv Piata (P < 0.05). By carrying out the multiple comparison between the situation before and after trampling, highly significant differences emerge between all the ecotypes observed in this study (P = 0.0078).

5. Discussion

1) Average biomass of Brachiaria ecotypes before the disturbance factor

The results obtained are that B. brizatha cv Piata comes in first position with (1273.5 Kg dm/ ha), followed by B. brizantha cv Xaraes (1078.16 kg dm/ ha), B. decumbens cv Baslisk (937.75 kg dm/ha), B. brizantha cv Nioka (802.16 kg dm/ha) and B. ruziziensis (689.84 kg dm/ha). These results would be due to the genetic character of each ecotype. Musale (2021) found different results still under Nioka conditions, i.e. B. cv. decumbens Basilisk, 3320.3 Kg ms/ ha, P. purpureum 3175.5 Kg ms/ ha, B. cv. brizantha Piata 2914.5 Kg ms/ ha, B. brizantha cv. Xaraes 2837.5 Kg ms ha and B. ruziziensis 1677.7 Kg ms ha.

This difference would be due to the planting period and the intrinsic qualities of the varieties chosen. Considering these results, B. brizantha cv Piata produces more (3.39 TLU) compared to other ecotypes.

The overall average obtained at Nioka without the intervention of this disturbance effect is 2.45 TLU. These average TLU requirements are totally lower than those obtained by Ngakpa (2018) in the conditions of Kisangani (17.9 TLU).

The difference in maintenance requirements observed could be explained by the influence of the environment and altitude.

5.1 Trampling effect before and after trampling

5.1.1. Rate and speed of resumption of fragments of Brachiaria strains

The recovery rate before trampling varied depending on the ecotypes. The low rate obtained is observed in B. brizantha cv Nioka (64.58%) unlike that of Ngakpa (2008) who found the lowest rate in B. brizantha (60%). Bogdan (1977) noticed this difference in the aforementioned rate between B. decumbens (83.5%) and B. ruziziensis (87%) in the grassland flora in Kenya and Tendonkeng et al. (2014) in tropical Africa.

Furthermore, the recovery rates of these ecotypes are generally quite rapid in the conditions of Nioka (> 62.5%) compared to those obtained by Ngakpa (Op. cit) (< 60%) in 2019 in the conditions of Kisangani on fleeting and exhausted soils. After trampling, the recovery rate decreased in B. brizantha cv Piata (61.45%) compared to the situation before trampling (72.9%); this reduction is also noted in B. decumbens cv Bazilisk (52.08%) compared to the recovery before trampling (82.29%); while the lowest recovery after trampling is observed in B. mulato (50%) unlike the recovery before (81.25%). This low rate of recovery after trampling can be explained by the passage of a high number of cattle for a long time over a small grazing area.

The variability in the recovery rate before and even after grazing of these varieties of Brachiaria under study could only be explained by the difference in the genetic background of the aforementioned ecotypes. Toutain (2014), Klein et al. (2014) and Nyabyenda (2018) attribute this difference in recovery rate and growth of forage species to morphogenetic differences which determine the structure of cover crops and influence the use and distribution of assimilates through the recovery and growth of the different constituent organs. of fodder populations.

The recovery results showed that B. decumbens cv Nioka recovered quickly (10.8 days) compared to other ecotypes, it is followed by B. brizantha cv Xaraes (12.6 days), B. ruziziensis (15, 8 days), B. decumbens cv Bazilisk (16.5

days), B. brizantha cv Piata (17.8 days) and the latest recovery comes from B. mulato (18.8 days).

These results are contrary to those obtained by Ngakpa (2019) in Kisangani B. decumbens cv Bazilisk (13.5 days), B. brizantha (20 days), B. ruziziensis (14.5 days) and the fastest recovery was was observed in B. mutica under the conditions of Kisangani. These differences would be due to the nature of the species used and the ecological conditions.

The high recovery obtained after trampling in Nioka would be influenced by the presence of manure deposited by livestock during grazing.

The speed of recovery of these ecotypes is interesting after grazing, which confirms the opinions of Schuffze-Kraft et al. (1992) and Roberts and Toutain (1999) cited by Chevalier (2015) and Bukles et al. (2016).

This would be a result of the water reserve maintained in the tissues of these varieties then, to the additional roots initiated at the internodes of ecotypes after their trampling, thanks to the presence of organic matter left by the cows.

As the dry period constitutes the painful moment deplored by most of our pastoralists and trampling could constitute an interesting factor during the rainy period and trigger the resumption of several bursts of strains of these ecotypes which could be used during the dry season. This could lead to the valorization of varieties with high tolerance and resistance such as B. mulato and B. braizantha cv Piata in Nioka as food to be provided to livestock in the event of scarcity due for example to a delay in the return of the rains following their growth quite fast.

5.1.2 Pruning of ecotypes of Brachiaria spp

The highest tillering was obtained after trampling by B. ruziziensis (312 tillers) and B. brizantha cv Nioka (312 tillers) and B. brizantha cv Piata (227 tillers) is influenced by the passage of animals through the deposit of manure. B. decumbens cv Bazilisk (191 tillers) and B. brizantha cv Xaraes (151 tillers) obtained a lower tillering because of their less resistance to trampling by cattle. However, this variation in tillering would be due to the genetic characteristics of each ecotype. Which corroborates the results of Messien (1986) and Romasteck (2000) in Steinfield et al. (2016) and Grimaud and Thomas (2020) who showed that tillering is a factor linked to species and varieties. This observation was already confirmed by Pizarro et al. (1986) cited by Gramier and Bigot (2021) on forage varieties in some ecotypes of Costa Rica.

The practice of this factor could certainly be capitalized on in the ecological conditions of Nioka and its surroundings, at very specific periods to cope with the obvious growing heat of global global warming.

5.1.3 Biomass of Brachiaria spp

The highest biomass production (1772.46 kg dm / ha) was obtained by B. brizantha cv Piata, which shows its adaptation to the conditions of Nioka and the good assimilation of organic matter coming from the deposition of manure by cattle. The other yields revealed by B. brizantha cv grazing.

By evaluating the two periods on the production of the biomass of Brachiaria ecotypes under examination, we note that the period after grazing turns out to be more interesting. And taking into account biomass production and carrying capacity; it appears that in the conditions of Nioka B. brizantha cv Piata could annually maintain 17947.7 Kg ms /ha, or 7.9 TLU followed by B. decumbens cv Bazilisk (14377.2 or 6.3 TLU), then B. brizantha cv Xaraes (13437.8 kg ms/Ha, or 5.9 UBT). However, B. brizantha cv Nioka; B. ruziziensis and B. mulato have low biomass production and lower carrying capacity (5.8 TLU and 5.4 TLU, 5.2 TLU respectively). Ngakpa (2019) found in Kisangani conditions 25.9 TLU for B. humidicola, 21.3 TLU for B. ruziziensis, 16 TLU for B. brizantha and 10.1 TLU for B. decumbens cv Bazilisk. We see that under the conditions of Kisangani the Brachiaria produce more biomass than in Nioka. To the above, and taking into account the aforementioned observation periods under the conditions of Nioka (Op. cit)) B. brizantha cv Piata could be used in fodder production and the five other ecotypes having interesting trampling performance must be used when it comes to controlled grazing.

Although the production of our ecotypes is generally interesting, it would be desirable to take into account the carrying capacity of the grazing area and the ecotype exploited. These cases corroborate those of Morel (1976) cited by Millen and Muc Farlane (1998) and Russel (1976) all cited by Toutain (2014) and Flore and Pontanier (2017) according to which the carrying capacity is a function of forage biomass and high-productivity grassland species favor high carrying capacity. Thus, Bowns and Bagley (1992) in Outtara and Louppe (2018) and Guilloteau (2022) add that the higher the animal stocking rate, the more vegetation production is reduced.

6. Conclusion

Our study sought to determine the effects of trampling on the biomass production of six ecotypes of Brachiaria in particular: Brachiaria decumbens cv Bazilisk; Brachiaria mulato; Brachiaria brizantha cv Xaraes; Brachiaria ruziziensis; Brachiaria brizantha cv Nioka and Brachiaria brizantha cv Piata in Nioka. The experimental design consisted of complete randomized blocks comprising six treatments (six ecotypes mentioned above) and repeated three times. The six ecotypes of Brachiaria were subjected to three factors of disturbance, trampling, burning, and weeds. The following parameters were measured: recovery rate and speed, tillering, biomass.

The results obtained are that

- The recovery rate is highest for Brachiaria ruziziensis before and after the disturbance factor. B. brizantha cv Nioka had the lowest recovery rate before and after this aforementioned factor; - Regarding the speed of recovery, the fastest speed is obtained before the disturbance factor by B. brizantha cv xaraes; slowest speed by B. brizantha piata;
- The highest tillage is obtained before by B. brizantha cv piata for the observed disturbing factor and the lowest is elucidated by B. brizantha cv xaraes. After this factor, B. ruziziensis gave more tillers for trampling while the lowest production was obtained by B. brizantha cv xaraes;
- The highest biomass for this factor before and after is obtained by B. brizantha cv piata while the lowest production is deplored by B. brizantha cv nioka and B. mulato.

Therefore, this factor induces certain beneficial influence on the productivity of some ecotypes of Brachiaria under examination in the ecological conditions of Nioka and then deserves to be promised for the cultures of herbivorous animals.

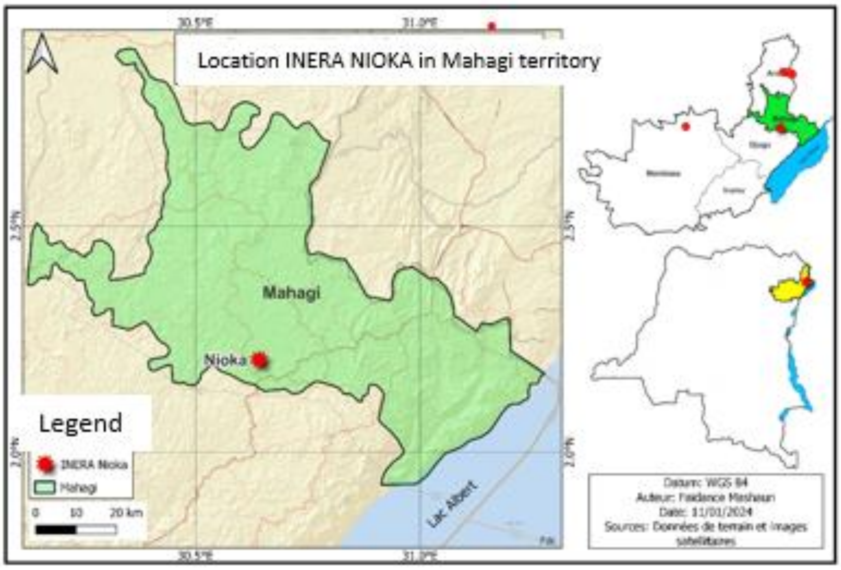

Figure 1. Map of the Mahagi territory locating the experimental site at INERA-Nioka

Experimental device of our test. The figure below illustrates the experimental setup for this test

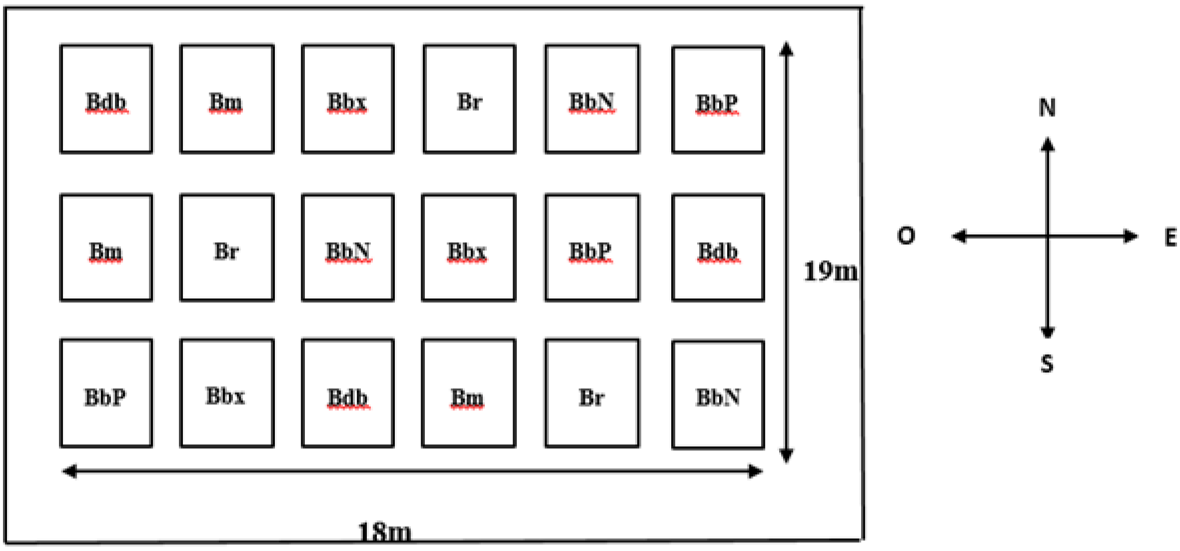

Figure 2. Experimental device used during the test

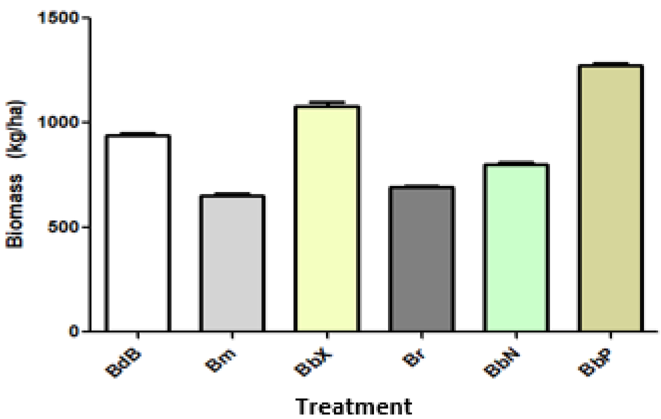

Figure 3. Average biomass production of ecotypes before disturbance factors Legend: Brachiaria decumbens cv Basilisk (Bdb); Brachiaria mulato (Bm); Brachiaria brizantha cv Xaraes (BbX); Brachiaria ruziziensis (Br), Brachiaria brizantha cv Nioka (BbN) and Brachiaria brizantha cv Piata (BbP)

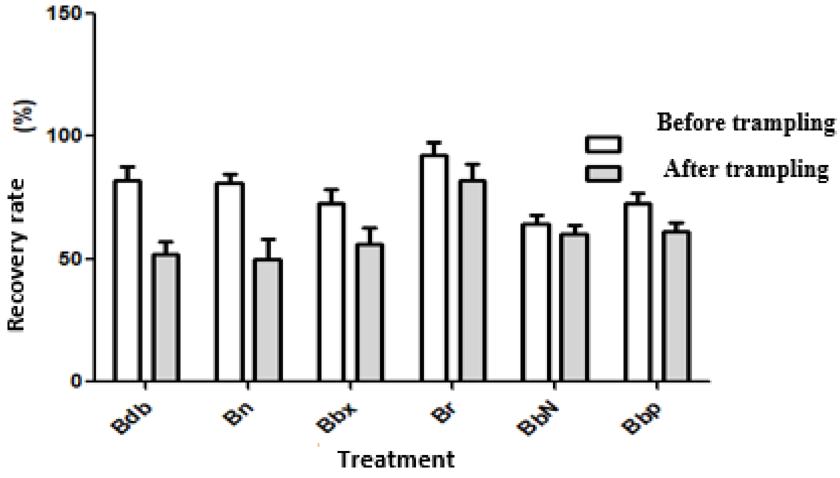

Figure 4. Recovery rate of Brachiaria ecotypes before and after trampling. Legend: Brachiaria decumbens cv Basilisk (Bdb); Brachiaria mulato (Bm); Brachiaria brizantha cv Xaraes (BbX); Brachiaria ruziziensis (Br), Brachiaria brizantha cv Nioka (BbN) and Brachiaria brizantha cv Piata (BbP).

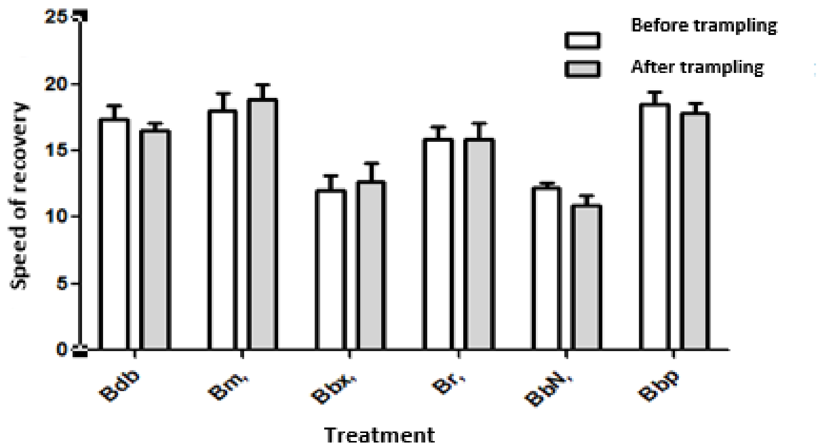

Figure 5. Recovery speed before and after trampling Legend: Brachiaria decumbens cv Basilisk (Bdb); Brachiaria mulato (Bm); Brachiaria brizantha cv Xaraes (BbX); Brachiaria ruziziensis (Br), Brachiaria brizantha cv Nioka (BbN) and Brachiaria brizantha cv Piata (BbP)

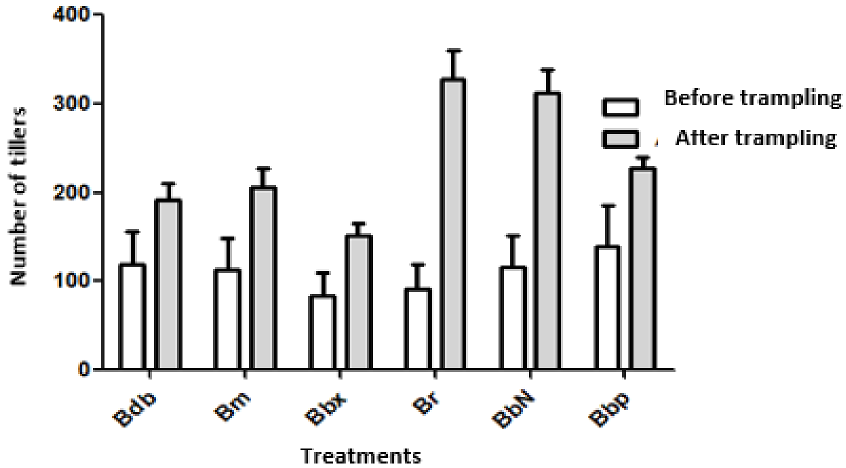

Figure 6. Tilling of Brachiaria ecotypes before and after trampling. Legend: Brachiaria decumbens cv Basilisk (Bdb); Brachiaria mulato (Bm); Brachiaria brizantha cv Xaraes (BbX); Brachiaria ruziziensis (Br), Brachiaria brizantha cv Nioka (BbN) and Brachiaria brizantha cv Piata (BbP)

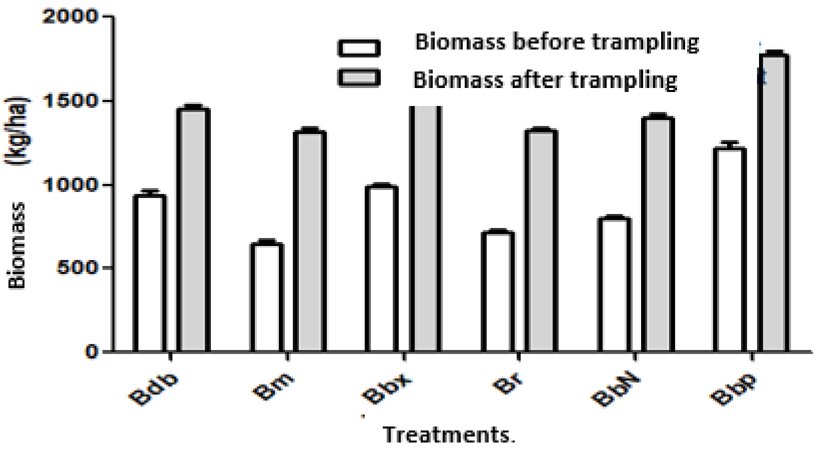

Figure 7. Biomass of Brachiaria spp ecotypes before and after trampling Legend: Brachiaria decumbens cv Basilisk (Bdb); Brachiaria mulato (Bm); Brachiaria brizantha cv Xaraes (BbX); Brachiaria ruziziensis (Br), Brachiaria brizantha cv Nioka (BbN) and Brachiaria brizantha cv Piata (BbP)

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