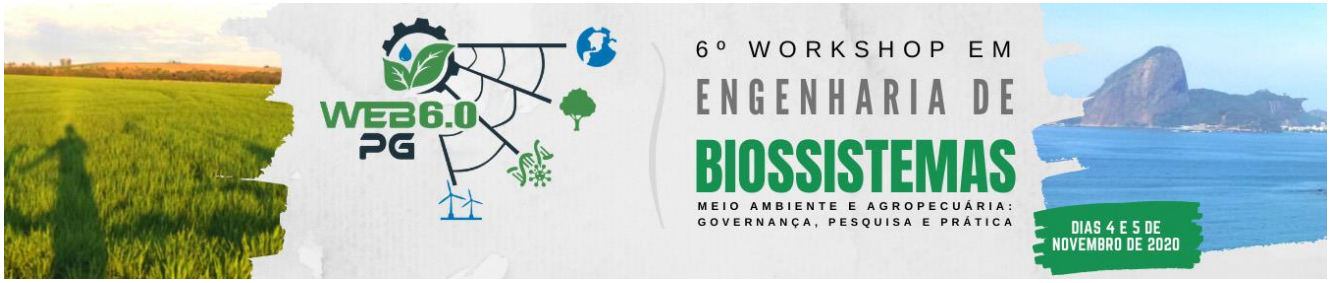

EFFECTS OF STEEL SLAG-BASED FERTILIZERS ON THE ENDURANCE TO HYDRIC STRESS OF THE *Brachiaria brizantha*

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Abstract
The necessity to increase the production of food, fibers, agroenergy and other farming products to serve the growing world population stimulates the efficient use of corrective treatments and fertilizers and the search for alternative solutions, as, for instance, the use of steel slag. The use of slag-based products in soil becomes an important resource for the decreasing of environmental impacts caused by storage and the final disposition of its raw material, which also converts into a viable source of income for the steel industry. Another factor of important vegetal production is the use of water, which has a fundamental role in the development of plants, that comes from being the main carrier of soil nutrients, aside from participating in a myriad of physiological functions. Thus, a scenario of hydric restriction causes plant stress and turns into one of the prime reducers of agricultural productivity. In light of the above, this paper had as its purpose evaluating the influence of the application of calcium silicate and magnesium, derived from steel industry residue, over the resistance to the hydric stress of the *Brachiaria brizantha* cv. Marandu forage, in accordance with the hydric provision available for this culture. The experiment was conducted in a greenhouse following a split plot design, with each plot carrying silicate and the subplots the water blades assessed (100%, 80%, 60%, 40% and 20% of the Field Capacity – FC), in an entire randomized design with four repetitions.

Keywords: soil corrective treatment; silicate; forage.

Presentation: https://youtu.be/p1FRAJUxVI8

INTRODUCTION

Pastures are the basis in livestock in Brazil and so, management techniques that envision the increase of its productivity, always aiming towards sustainable solutions, must be applied. With that in mind, it's necessary to known the type of soil and weather of the region, in addition to checking the behavior of the culture in a condition of hydric stress, for, according to Gaur et al. (2020), this affects negatively the photosynthesis, the transport, the storage of nutrients and, consequently, the productivity of the culture.

As per said by Costa et al. (2006), the species of the *Brachiaria* genus are the most utilized in Brazil due to its high production of dry matter, resilience, good nutrition value and its ability to endure the diverse edapho-environmental Brazilian conditions.

In order to optimize the productivity of this important forage, we must also consider the correction of acidity of the soil, for in Brazil a majority of the soil is highly weathered and, consequently, acidic. Therefore, liming becomes fundamental for establishing and increasing the performance of the culture. In the country, the most utilized material for correcting soil acidity is limestone, however, products that come from steel slag are gaining more space nowadays, because, according to Prezotti and Martins (2012), they are rich in calcium silicate ($CaSiO_3$) and magnesium silicate ($MgSiO_3$), emerging also as an alternative for the correction of the pH in national soil.

Recent works offer signs of the benefits of Silicon (Si) to the plants, with emphasis to its action in the reduction of vegetal stress in hydric stress conditions. In light of the above, this paper has the purpose of examining the effect of Agrosilício Plus in the endurance of the *Brachiaria brizantha* cv. Marandu forage to hydric stress.

MATERIALS AND METHODS

The experiment was carried out in a greenhouse in the Gragoatá Campus of the Fluminense Federal University (Universidade Federal Fluminense – UFF), in the municipality of Niterói/RJ (22º54'00'S; 43º08'00''W and alt.: 8m), over the time period of July 16th 2019 up to February 10th 2020.

The experiment was conducted in plastic vessels of 4 dm³. The soil was classified as dystrophic Red-Yellow Latosol of clayey texture, according to the Brazilian System of Soil Classification (EMBRAPA, 2018).

The experimental design displayed a factorial arrangement constituted by 8 treatments (5 X 3): 5 levels of irrigation (100%, 80%, 60%, 40% and 20% of Field Capacity – FC); and 3 sources of corrective treatment – Control (C), Dolomitic Limestone incorporated (DL) and Agrosilício Plus incorporated (AP) – with 4 repetitions, totalizing 60 experimental units.

In the initial stage of the experiment, irrigations were conducted considering 70% of the FC in all of the treatments, as a way of ensuring uniformity of germination and complete setting of forage plants in the vessels. By the end of the first cycle (45 days), the plants were cut in a 10 cm height, and so, the varied irrigation plates were applied through the system of vessel weighting, which lasted until the end of the experiment. All of the treatments were subjected to 4 cycles of 45 days, the first being disregarded, with cuts of vegetal material and analysis of the macro and micronutrients.

In the end of each cycle, data regarding the Leaf Height, the Aerial Dry Matter and the Root Dry Matter was collected. All of the green mass harvested in the samples was packaged in paper bags, properly identified, and immediately weighted. Next, the samples were set to dry at 65 ºC, in forced-air circulation, over a period of 72 hours or until they reached constant weights. After drying, the samples were weighted and milled, and then sent over for chemical analysis of the dry matter. The data was subjected to variance analysis (ANOVA) and, due to being qualitative variables, they were subjected to the Tukey test, with a level of significance of 5% probability.

RESULTS AND DISCUSSION

Figure 1 presents the results of Leaf Height in each of the irrigation blades and treatments. In the blades with 100% and 20% of FC none of the treatments diverged statistically, except C. With 80% and 60% of FC, all remained the same. And with 40% of FC there was a differentiation between AP and C. We stress that DL and AP presented a behavior of decrease as the hydric availability declined, with 100% of FC presenting the best, and 20%, the worst.

Such result was also ascertained by Oliveira et al. (2016), who observed that the decrease of water concentration in the soil brought smaller heights to the plants subjected to the highest tensions of water in the soil.

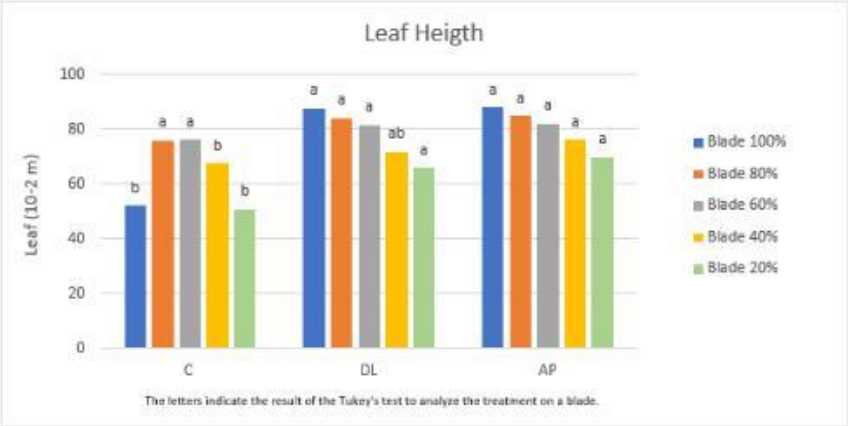

Figure 1: Leaf height.

Figure 2 shows the results of Aerial Dry Matter and Root Dry Matter in each of the irrigation blades and treatments. For the Aerial Dry Matter, there was no statistical difference between DL and AP, but there was among them and C in all of the levels of water reposition.

For Root Dry Matter, with 80%, 60% and 20% of FC there was no difference between treatments. With 100% of FC, there was difference between AP and C. And, finally, with 40% of FC, the C and DL treatments didn't diverge among themselves, but AP presented the best result. This is related to the positive effect of Silicon, derived from the AP. Besharat et al. (2020) observed that the absorption of Silicon by the plants has a positive effect on the development of roots and its outcome goes beyond the mitigation of hydric stress.

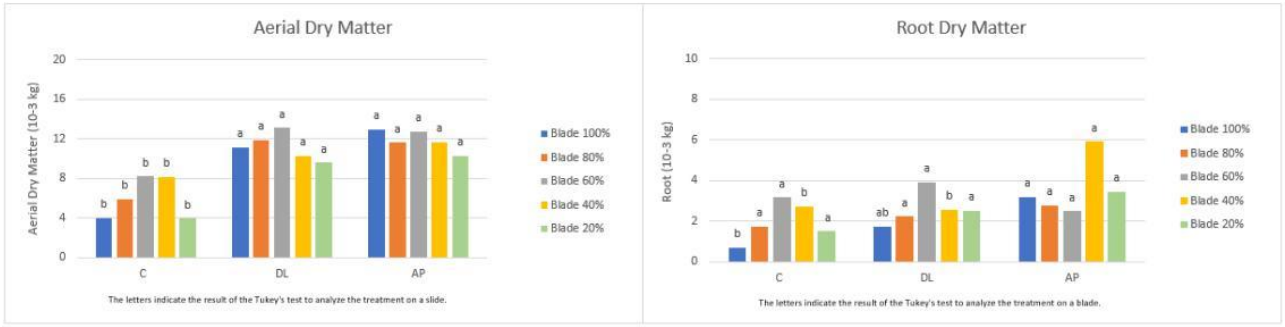

Figure 2: Aerial and Root Dry Matter.

Such responses corroborate with Liang et al. (2007), who verified that the Silicon acts as a physical or mechanical barrier in plants, for it takes part in its metabolic and physiologic activities, which provides greater resistance to stress, specifically the hydric kind. Gaur et al. (2020) state that the Si increases plant's resistance to the biotic effects, such as insects and plagues, as well as to the abiotic effects, like hydric and saline stress. Possibly, this explains why the treatment with Silicon was the one that displayed the best performance in the smaller blades.

CONSIDERATIONS

Both treatments, Agrosilício Plus and Dolomitic Limestone, proved to be efficient in fostering endurance to the hydric stress of the *Brachiaria* forage. This, under the effect of AP, had the best growth outcome in the parameter of roots subjected to hydric stress, which might lead to greater benefits in the long run for the aerial and dry matter part.

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