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EFFECTS OF CALCIUM AND MAGNESIUM SILICATE RESIDUAL STAINLESS STEEL INDUSTRY, LIMESTONE AND PHOSPHORUS APPLICATION IN THE DEVELOPMENT OF BRACHIARÃO PLANTS (*Brachiaria brizantha*)

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RESUMO: O trabalho foi desenvolvido no campo experimental da Univale em Governador Valadares, Minas Gerais. Os blocos experimentais foram de 4,0 m x 4,0 m e os tratamentos: controle, fósforo, Silicato de cálcio e magnésio, Calcário, Silicato de cálcio e magnésio + calcário, Silicato de cálcio e magnésio + fósforo, Calcário + fósforo e de Silicato de cálcio e magnésio + calcário + fósforo. Logo foi distribuído as sementes de Brachiarão (*Brachiaria brizantha*). Todos os tratamentos foram fertilizados com Nitrogênio e Potássio. Depois de distribuir as sementes, estas foram incorporadas. As plantas foram colheitas após 75 dias de plantadas. Para estudos quantitativos das partes verdes e secas, as plantas foram colhidas a 10 centímetros da superfície do solo. Na avaliação do peso verde, o melhor resultado obtido foi com o tratamento de Silicato de cálcio e magnésio + calcário + fósforo. O tratamento com a plena aplicação do calcário não beneficiou o desenvolvimento das plantas, apresentando valores de produção próximos ao tratamento controle. Os tratamentos com o silicato de cálcio e magnésio apresentou uma produção 21% superior para os tratamentos sem silicato de cálcio e magnésio. Nos tratamentos com e sem calcário, essa diferença foi de 10% e para o fósforo de 9%. Na decomposição dos fatores, os tratamentos com silicato de cálcio e magnésio apresentaram produtividade 17% superior para o sem silicato de cálcio e magnésio. Para o tratamento com o calcário esta variação foi de 12% e para o fósforo 17%. Estes resultados demonstram que os nutrientes minerais dos fertilizantes, corretivos devem atuar conjuntamente no solo, tornando difícil e de pouco ação, quando aplicados de forma individualizada.

Palavras Chave: *Brachiaria brizantha*, Silicato, Calcário.

ABSTRACT: The work was developed in the experimental field of Univale in Governador Valadares, Minas Gerais state. The experimental portions were of 4,0 m x 4,0 m and the used treatments were: control, phosphorus (112,5kg/ha), calcium and magnesium silicate (1875kg/ha), Limestone (1875kg/ha), calcium and magnesium silicate + limestone (937,5kg+937,5kg/ha), calcium and magnesium silicate + phosphorus (1875kg+112,5kg/ha), limestone + phosphorus (1875kg+112,5kg) and calcium and magnesium silicate + limestone + phosphorus (937,5kg+937,5kg+112,5kg/ha). All the treatments were fertilized with nitrogen and potassium. Soon was distributing the seeds of brachiarão (*Brachiaria brizantha*). After to share the seeds were slightly incorporate with the hoe. The plants were to grow in area of 0,5m^2 with harvest 75 days after plant of seeds. For studies quantitative of height green and height dry the plants they was picked to 10 centimeters the soil surface. In the evaluation of the green height, the best result was obtained with the treatment calcium and magnesium silicate + limestone + phosphorus followed by the treatment calcium and magnesium silicate + limestone and calcium and magnesium silicate + phosphorus. The treatments with the complete application of limestone (1875kg/ha) didn't benefit the development of the plants presenting close production values to the treatment control. In the decomposition of the factors, the treatments that used the calcium and magnesium silicate presented a production 21% upper to the treatments without calcium and magnesium silicate. In the treatments with and without limestone, this difference was of 10% and for phosphorus of 9%. For the dry weight of the plants the results presented few differences in relation to evaluation of the humid weight, with the best result being obtained by the treatment calcium and magnesium silicate + limestone + phosphorus followed by the calcium and magnesium silicate + limestone and calcium and magnesium silicate + phosphorus. The worst results were obtained with complete application of limestone and complete application of calcium and magnesium silicate. In the decomposition of the factors, the treatments with calcium and magnesium silicate presented productivity 17% upper to the without calcium and magnesium silicate. For treatment with the limestone this variation was of 12% and for the phosphorus 17%. These results demonstrate that the fertilizers, correctives and your nutrients minerais to act jointly in the soil, turning difficult and little representative the individualized action of the inputs and that the silicate also possesses important participation in the development of the plants.

Keywords: *Brachiaria brizantha*, silicate, limestone

1. INTRODUCTION

The economical importance of pastures in Brazil can be easily characterized, because they constitute the base of production systems of bovine culture, being responsible in great part by 5.7 million tons of meat and 20 billion liters of milk produced in 1998. Brazil presents 80% of your located territory in the tropical area; which allows explores the great potential of production of your pastures, with accentuated reduction of production costs and possibility of participating in the international market and the exportation of the surplus. However, estimates indicate that about 50% of established pastures in the great pastoral areas of the country are degraded, in function of inadequate handling once those were and are submitted. The low physical persistence of pastures in Brazil is result of the instability of the adopted production systems that are affected by adverse factors as, for instance, the low adaptation certain for certain species, the climate conditions and mainly of the soil types. On the other hand, the inadequate handling of pastures, above all for the employment of discharges rates of

animal capacity, being disrespected the variation of capacity support of pastures along the year. Other fact is the non replacement of retired nutrients for animal graze, they end for worsening the adverse conditions of environment the one that the forage eventually are inserted, Wendling (1998). Those conditions of the pastures in Brazil have not allowed adequate meat and milk productivities over 40 kg of weight/ha/year and 651 liters of milk/ha/year, respectively, FAEMG (1996). The process of degradation of pastures involves several stages, but it culminates with the alteration of your botanical composition, characterized by the emergence of weeds and the loss of vitality of the forage species of interest. The fact is that the bovine ones affect also the rhythm of growth of the forage, through it defoliates her (removal of leaves) caused by grazing, besides the trampling on the plants. In the Cerrado area, about 34 million hectares of pastures formed 20 years ago are in different advanced stages of degradation. These areas present losses of over 36 million arrobas/year. This weigh loss of animals during dry period is corresponding to the 450 thousand dead animals signifying losses of billion dollars a year. In the Humid Tropic area, about 62% of the deforested area is occupied by the bovine creation, transformed in 25 million hectares of pastures, planted in the last decades. However, estimates point that the half of those pastures is degraded or in degradation process (Simão Neto & Dias Filho, 1995). The more limitation factors of production of pastures in the Amazonian region, according to Serrão (1986), are the fertility of soil, especially the luck of phosphorus. Still in the Amazon area, it is considered that 6% of the pastures will degrade by year which would implicate, theoretically, in the necessity of the devastation annual of more 1 million hectares of forest to maintain the same productivity. Due to the fact that one does not have the detailed information of degradation level of pastures in Rio Doce valley, there are necessary economically viable recovery proposals which are and ecologically appropriates for each situation and stage of degradation. Still there were not elaborated programs of recuperation of pastures for the Rio Doce valley. In this the exploration of the natural resources historically was always characterized by to be extractive. The extensive exploration of the wood and pegmatite minerals, strong metallurgical activities and, finally, the inadequate use of the pastures brought harmful consequences to the environment, affecting strongly the natural resources (soil and water).

Baruqui (1982) and Favero (1997) suggest that the verification of some environmental and agronomic characteristics can demonstrate the environmental degradation in the area. According to Baruqui (1982), the capacity of animal support of "colonião" grass was of 2.0 animals/ha in the beginning of the occupation of the region of Vale do Rio Doce, changing until now down to 0.8 animals/ha, considering the loss of 2.400 tons of clay a day, drained by waters Rio Doce. The causes of this losses and possible recovery methods are known, however, the use methods seems to disrespect the fact that to maintain the economical and ecological usability of the pastures, by appropriate handling, seems to be less economical in comparison with the methods of recovery of them.

Some recovery techniques are more recommended than others, depending on the degradation level of pasture and the soil. The recovery always has higher cost in comparison with the maintaining. The techniques of recovery of pastures degraded that they don't promote the fertilization, such as only the mechanization use, flaws were shown in the attempt of recovering the pastures Arruda *et al*. (1987) and Soares Filho *et al*. (1992).

The answer to the application of fertilizers in degraded pastures if it owes, probably, not only to the increase of the immediate readiness of ions provided by the fertilizer, but also to the increment in the organic matter mineralized of the soil, which accelerates the process of recycle of nutrients minerals Nescient Jr. *et al*. (1994). Pastures of B. decumbens (10 years of use), formed in soils Podzolics Red-yellow dystrophic presented larger matter productions it evaporates (kg dry matter/ha), when recovered through the managing with macro and micronutrients, besides subsequent addition of nitrogen.

Arruda *et al*. (1987) verified that several physical-mechanics treatments, with or without the use of fire, still being used by farmer, did not affect the recovery of the pasture of B. decumbens significantly, which presented production of dry matter of 844 kg/ha. However, the application of 22 kg/ha of P (Phosphorous) elevated the production of the pasture for 3.386 kg dry matter/ha, and the application of others nutrients minerals (N, K, Ca and Mg) together with P provided still a production of larger, about 4.266 kg/ha.

Silicon is one of the most abundant elements in the terrestrial crust and is absorbed from the soil by all the plants, reaching about 10% of the dry matter of some species. In spite of not being proved, its main feature is its influence in the resistance of the plants against the attack of bacteria, mushrooms, nematodes and insects, together with verified actions like the improvement of the nutrition state and also in the reduction of the respiration of the plants. To be absorbed by the roots it is necessary that the silicon is in the soluble state. When

absorbed by the plants it is allocated in its majority at the aerial part.

In general, forages tend to absorb more silicon in comparison with plants of other families. They were already identified up to 11.8% of silicon in the old leaves of wheat, 4.49% in the peels of rice and 3.52% in the wheat peels (Barber & Shone, 1966; Malavolta, 1980). In the case of the sugar cane, a smaller silicon proportion influences in its evaporation (up to 1.9% in the leaves) and in the activity of photosynthesis and the production of dry matter, could reach during your cycle, for up to 250kg of silicon/ha (Korndorfer *et al*., 2004).

The livestock of milk and cut of the area in the Rio Doce Valley depends basically on the pastures, source of victuals cheaper for bovine. However, great part of the areas of pastures of the Rio Doce Valley, corresponding to 85% of the rural area is degraded or in accelerated form, being necessary to create economical alternatives seeking to the recovery of those areas.

The present work reports the effects of the application of calcium and magnesium silicate (Agrosilício®) separate and also together with other fertilizers and correctives seeking the pasture implantation in soil of average fertility degraded.

2. METHODS

This work was developed in the Agrariculture Department of the UNIVALE at Governador Valadares, MG. This nucleus has an experimental area of 320ha with representative soils of the region and pastures showing degradation in different degrees. Experimental sections of 4mx4m were used. The selected areas have low natural fertility, common in the region of Vale of Rio Doce. In the implantation of this work the following treatments were used: Application of phosphorus (112.5kg/ha), *agrosilício* (calcium and magnesium silicate) (1875kg/ha), limestone (1875kg/ha), *agrosilício* + limestone (937.5kg+937.5kg/ha), *agrosilício* + phosphorus (1875kg+112.5kg/ha), limestone + phosphorus (1875kg+112.5kg) and *agrosilício* + limestone + phosphorus (937.5kg+937.5kg+112.5kg/ha). The applied amounts were defined in function of the result of the chemical analysis of soil samples. In the treatments-limestone treatment were applied 50% of the recommended doses for each product. Three repetitions were done for each treatment. All the areas were fertilized with nitrogen and potassium, in agreement with the specifications of the manual of recommendation of fertilizers and correctives for the Minas Gerais State. After adubation, *brachiarão* seeds (*Brachiaria brizantha*) were sowed and incorporated superficially in the soil by using an equipment named “hoe”. The experiment was installed before of period to raining of region and led without irrigation. After 75 days, plants were taken off, accomplished by using a sampling model of 0,5m^2, placed in the center of the area and done a collection of the aerial part. The plants were cut at 10cm over the surface of the soil and accommodated in plastic sacks to reduce the loss of water by transpiration. After the cut of the green plants weight was obtained. Soon after, a sample of each portion was removed and again the weight determined. This sample was placed in dryer (75^o C for 72 hours) until to constant weight. After this period the plants were weighs to obtain the dry weight. With these results the evaporation rates of the plants were determined by three repetitions. Analysis of variance and probability test of means by Tukey at 5% were performed.

3. RESULTS AND DISCUSSION

In the field test, the associated of the *agrosilício*, limestone and match were evaluated. The correctives were always applied in the same recommended amount. The mixture of *agrosilício* + limestone was made in the proportion of 50% + 50%, independent of PRNT of both.

Figure 1 shows the production of dry matter of the aerial part, we can observe and conclude that the different treatments lead to different production of the *brachiarão* plants in correlation to the portions of *agrosilício* used or not was about approximately 17%, similar to the treatments with and without phosphorus. Treatments with limestone permits increases in the production of the Brachiaria of 11.6% when compared to the treatments without limestone.

In the evaluation of the green matter, the differences of the contrasts between the treatment with or without *agrosilício* are of about 21.0%. This is not observed in the portions with and without limestone where the difference was only nearby 10.6%. The difference between the portions with and without phosphorous were nearly 19.1% (Figure 2).

Figure 3 shows individually results of the eight treatments in relation to the production of dry matter of the *brachiarão* plants. The highest effects for the plants was verified in the portions with the use of the two correctives (limestone+"agrosilício"), besides the phosphorus. The three treatments of better acting presented the combined “agrosilício” with other elements. In these conditions, the “agrosilício” used alone didn't present good results, similar to the use of the limestone.

In the evaluation of the green matter (Figure 4), the influence of treatments was plenty similar for the dry matter weight, whereas the use of the

"agrosilício", presented better acting in the development of the plants, mainly in the mixture with the corrective and the phosphorus. The use of the inputs isolated of mixture of the limestone and phosphorus present values similar to the witness.

At the field tests, the acting of the associated "agrosilício" in relation to the other substances was evident. This fact can be associated to the combination of the action of the elements in the soil, besides the exclusive elements of the inputs as phosphorus in fertilizer, the carbonate in the limestone and the silicate in the *agrosilício*. The corrective do not present calcium and magnesium in your composition. In contrasts we notified that the effect silicate presented higher importance in the development of the plants when compared to the effect of carbonate, in spite of the addictive observed in the development of the plants when the two elements are placed in the soil simultaneously. The effect phosphorus was important in the evaporation of the plants, mainly in this tested area where the level of this element in the soil is naturally low. The phosphorus also increases the development of the *brachiarão*.

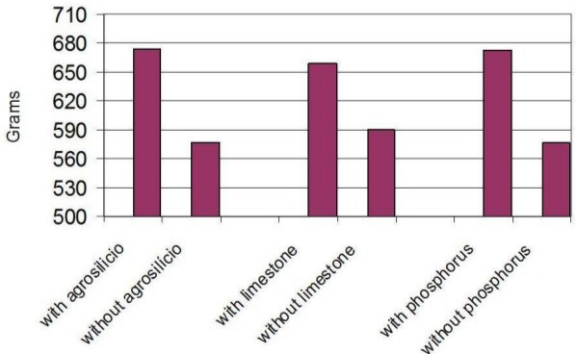

Figure 1 - Effect of the differences of materials used in the soil against the production of dry matter of the brachiarão (Brachiaria brizantha) for the first cut.

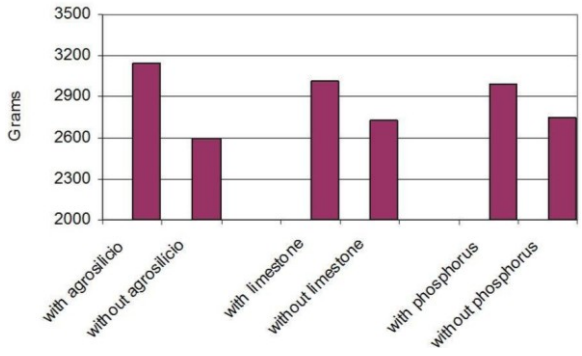

Figure 2 - Effects of the materials used in the soil by the production of green matter of brachiarão (Brachiaria brizantha) of the first cut.

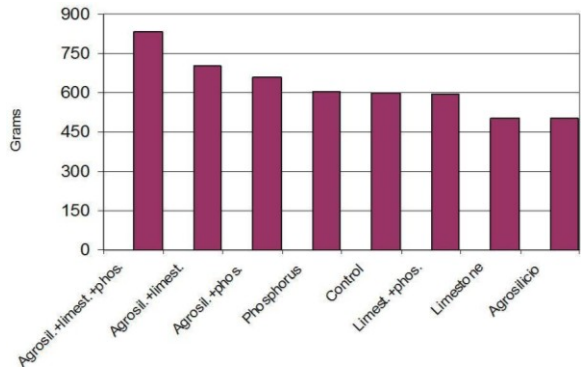

Figure 3 - Effects of treatments the production of dry matter of the plants of brachiarão (Brachiaria brizantha) of the first cut.

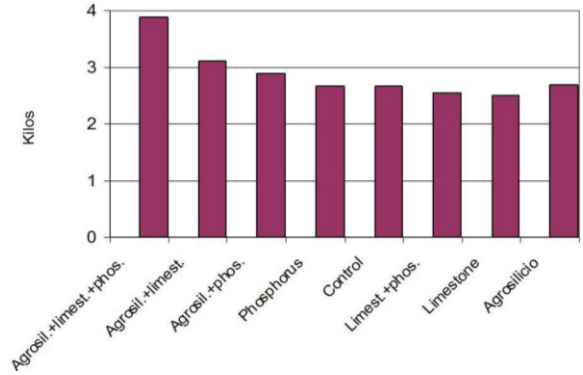

Figure 4 - Effects of treatments the production of green matter of the plants of braquiaria (Brachiaria brizantha) of the first cut.

4. CONCLUSIONS

The results obtained show that the silicates presence in the "agrosilício" act in the development of *brachiarão* in a significant way principally when associated to other necessary nutrient minerals.

These results prove that "The Minimum Law of Liebig" where all the essential elements for the plants should be present in high concentration levels. The deficiency of only one of them induces the reduction of production, even if the other elements are in high levels. In the treated case we can also consider the silicate as an element that increases the production of this plant.

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